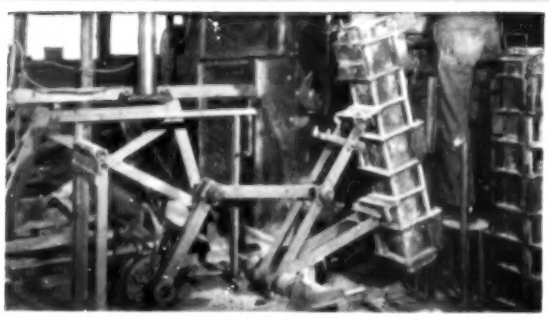
JUNE 1954

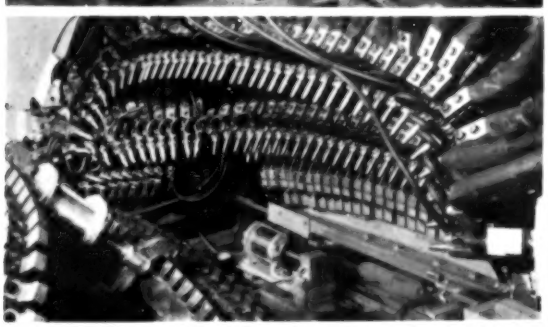
APPLIED HYDRAULICS

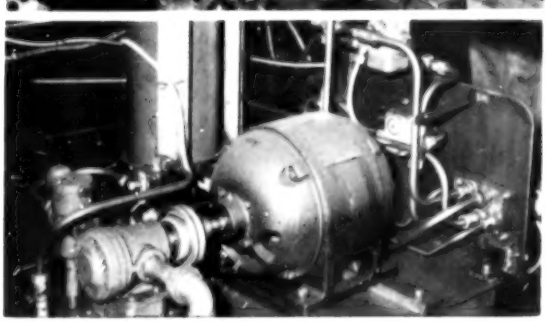
FRANCHISE CIRCULATION

THE MAGAZINE OF **FLUID POWER** TRANSMISSION

INCLUDING AIR CONTROLS AND AIR CIRCUIT DESIGN; ELECTRICAL CONTROLS







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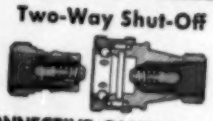

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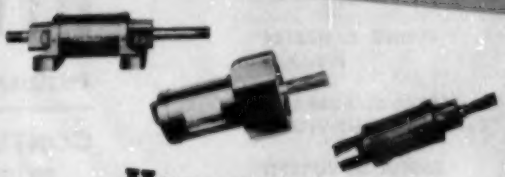

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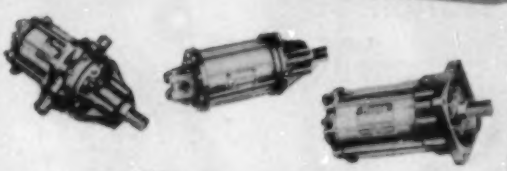

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PNEUMATICS - HYDRAULICS - ELECTRICAL CONTROLS

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Fluid Power Lines

Problems with Oil Viscosity

When oil viscosity changes during machine operation, one of the major troubles is variation of cycle time. Changing viscosity means changing oil temperature. The reason for high temperature is not always obvious. On the installation described by Ben Blake and Allan Steel in this issue, a careful study of the circuit and machine operation brought out the trouble spot. On page 60, they tell you about the circuit change they made to maintain constant cycle time.

Drill Feed Designs

A solution to the problem of deep hole drilling is described by Paul Romine and Andrew Armstrong in this issue. The hydraulic drilling device reciprocates automatically to drill a deep, small diameter hole in steps.

If there is such a thing as "the oldest machine shop practice", it could be drilling holes. Because of the long shop history, there is a large amount of data on drilling methods. Despite all the available data, new materials and increased production demands require continuous development of drilling equipment.

Today, machine shops can apply automatic drill feeds powered by air, oil or combination of air and oil. Use of these feeds result in greater production, less operator fatigue, improved quality and longer drill life. Electrically controlled fluid power circuits provide rapid approach, fine feed and rapid return. Variable metering valves and a wide range of feed adjustment and back pressure circuits prevent drill lunging at break through.

Pressure Switches

Cycle control with pressure switches is being widely used on many hydraulic machines. However, the use of this component has been the source of considerable headache to many users. It need not be troublesome if its limitations are known and the proper circuit is arranged. Rudy Esser, of TEC Engineering has prepared the article which shows pressure controlled accumulator circuits. The circuits have proved successful over many cycles of operation.

About the July Issue

There will be a section of design articles on automatic equipment. These articles will cover the electrical control aspects of air or oil powered transfer mechanisms, and mechanical designs for fluid powered transfer devices. Drawings will illustrate devices for clamping, indexing, transferring and rollover. Suggestions for automatically positioning and handling work will help you solve many design problems.

One article will deal with the application of fluid power drives to automatic systems in processing industries.

Modernization of hydraulic systems will be discussed in a design article by Harry Mortenson of The Yoder Company.

"It's a simple motion . . .

. . . but it's costing us a lot of money". That's what the boss said about the unloading operation which was taking the time of three men. What was finally done to cut the cost of this simple motion is described on page 82.

Prize Paper Contest Closes July 1st

July 1st is your target date for submitting an article to win one of the cash awards in the 1954 APPLIED HYDRAULICS Prize Paper Contest.

The contest judges, D. F. Green, chief engineer, Williams-White & Co.; Frank L. Mackin, General Motors Institute; and John T. Marshall, chief engineer, Hamilton Division, Bendix Aviation Corporation, will evaluate each entry. Announcement of the award winners will be made in the October issue of APPLIED HYDRAULICS. Articles, winning the top three prizes of $500, $300 and $200, will be published in the October issue.

Checks will be presented to the three top prize winners at a luncheon meeting of the National Conference on Industrial Hydraulics being held in Chicago on October 14 and 15th.

There are four $50 prizes making a total of $1200 in cash awards. All papers not winning an award but rated by the judges to merit publication will be paid for at our regular rates.

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Cartridge design permits rapid servicing without breaking line, thus reducing downtime and maintenance costs!

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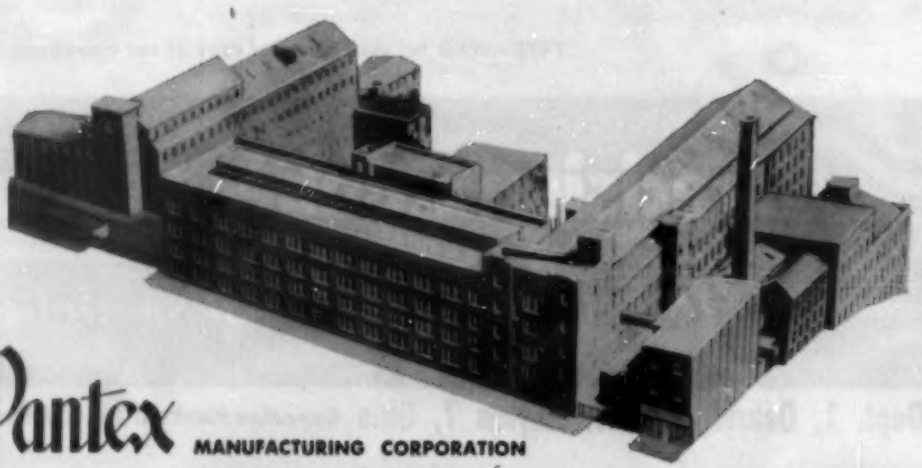
Photo of the 250,000 sq. ft. Pantex plant at Pawtucket, Rhode Island



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Types Available: Spring offset, spring centered and no spring. Available in 24 different assemblies of varying sub-plates, spool types, and spool springs.

Hollow spool design for true open center and tandem use • extremely compact, can be mounted close to cylinder • controlled with hand, cam, or other pilot valve • easily mounted on existing installations where higher pressures are desired.

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Port Size: ¾" Only
Flow Rate: 16 g.p.m. recommended
Types Available: Single solenoid with spring offset spool. Double solenoid with no spring and also spring centered spool. Available in 24 different assemblies of varying sub-plates, spool types, spool springs and solenoids.

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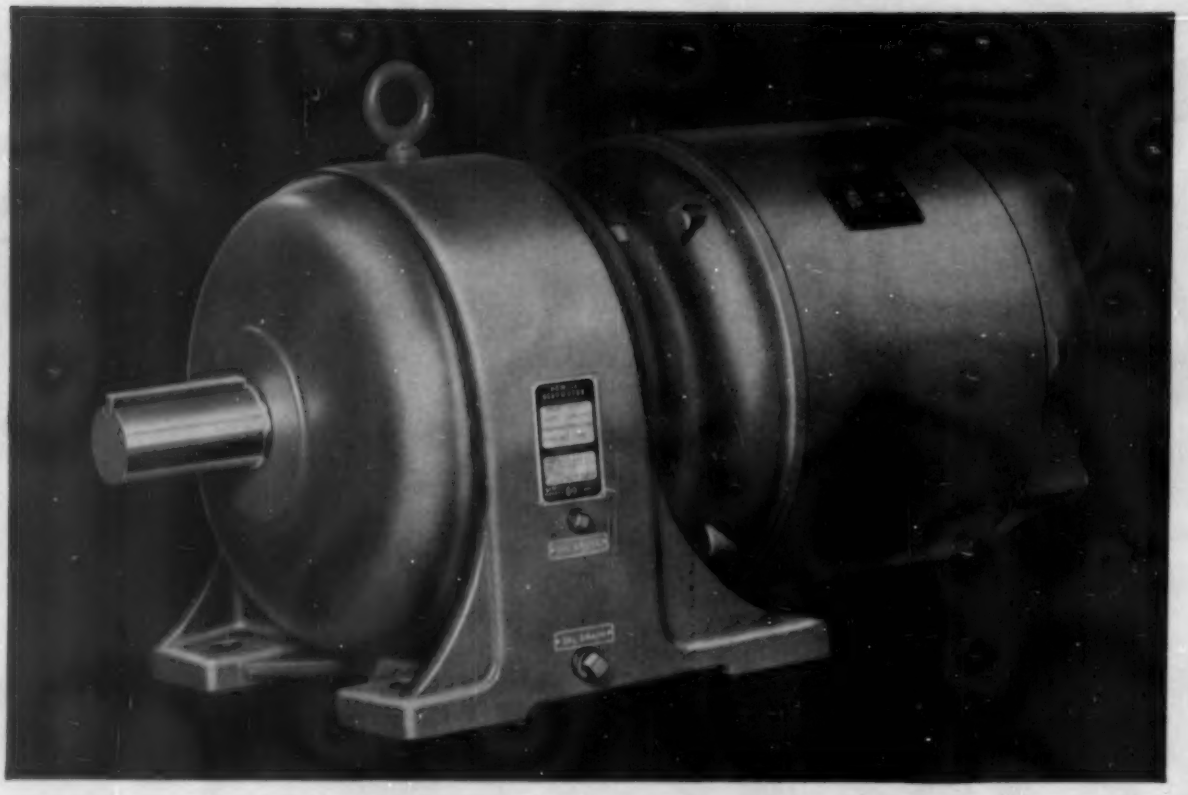

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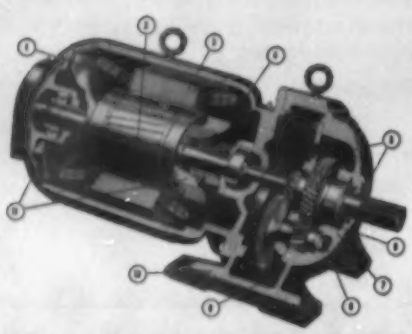

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9. Large oil reservoir
10. Heavy, cast-iron construction
11. Superior cooling

New dependability, greater starting torque and top efficiency, with output speeds as low as 7.5 rpm. are now available in Howell Gear Motors.

This compact, single-unit motor may well be the answer to your gear reduction problems. Combining the finest in heavy duty industrial gearing with the best in motoring, Howell Gear Motors reduce drive failures and production downtime.

Howell Gear Motors use duti-rated, lifetime gearing, with file-hard tooth surfaces and tough, resilient cores. They are available in all types of enclosures, from 7.5 to 780 rpm. with a capacity range from 1 to 30 hp., in all three AGMA service classifications.

For full information on Howell Gear Motors, contact the Howell man in your area, or write the factory direct for Bulletin GM-1.

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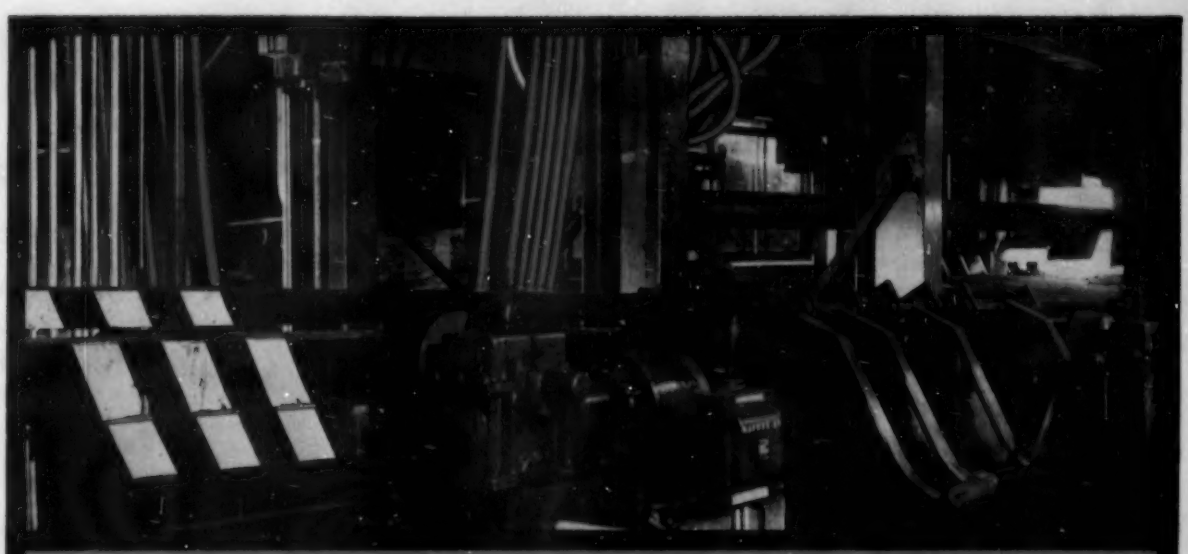

The Timken Company Protects $500,000 Furnace With—

FIRE-RESISTANT PYDRAUL

First tunnel-type furnace for billet heating uses 1,000 gallons of Monsanto fire-safe hydraulic fluid

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Pydraul: Reg. U. S. Pat. Off.

Near heat or flame, ordinary hydraulic fluid is a serious hazard. Spraying from a line break, it can ignite to cause injuries, loss of production, costly equipment shutdowns.

That's why The Timken Company insisted on Pydraul in this new heat-treating furnace at Canton, Ohio, built by Swindell-Dressler.

Pydraul will not sustain flame. In tests, when sprayed into a 6000°F. oxyacetylene flame, it does not support combustion. At Timken the furnace temperature may go to 2300°F. Heat that would set ordinary fluid aflame does not ignite Pydraul.

Since industrial fires give no warning before they start, check the hydraulic fluid now used in your plant. Is it fire-resistant? If not, let us tell you about Pydraul . . . a recent price reduction makes it more than ever the most economical fire-resistant fluid in actual use. For information, call any Monsanto office.

This report, "Pydraul F-9," will be sent on request. MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, Box 478, St. Louis, Missouri.

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SERVING INDUSTRY WHICH SERVES MANKIND

GROWING HORIZONS FOR FLUID POWER

NEWS • ACTIVITIES • PLANS

New Laboratory for Oil Power Study

An educational and research laboratory in oil hydraulics—the most complete of its kind in the United States—has been established at Illinois Institute of Technology in Chicago.

The new laboratory offers a broad educational program ranging from intensive short courses to graduate-level research.

The program was set up at the request of numerous industries now using oil hydraulics, according to Dr. Victor L. Streeter, research professor of mechanics at Illinois Tech.

"While not new," Streeter said, "oil hydraulics is becoming increasingly important. This is because it can deliver more power than electricity for a given weight or space. In the modern factory practically every machine tool is powered or controlled by oil hydraulics."

High Pressure Aviation Pneumatics

The interest of the aviation industry in high pressure pneumatic systems is real and the progress that is being made is real. The availability of 3- and 4-stage air compressors has already permitted a number of auxiliary services and standby systems to be air operated. The advent of the jet engine gives an abundant source of air. The development of the efficient small air turbine makes it practical to operate many of the primary services including pumps, alternators and other units. The reliability of pneumatic components is another factor. It is significant that more and more services in the newer aircraft are being approved for pneumatic power.

Where to with Atomic Energy?

"We might," said J. M. Davies, director of research, Caterpillar Tractor Co., "use radioactive materials to test piston ring wear. By running a radioactive ring in an engine we will build up radioactivity in the crankcase oil, thus giving a direct indication of the wear on the ring. We can complete the test with the aid of a Geiger counter."

It would appear that the only limits to the application of atomic energy to industry is the limit of ingenuity and imagination.

Solution for Emergency Actuator

Aircraft people have long been looking for a completely reliable source of energy for "one shot" emergency duties such as canopy or hatch ejection, safe jettison of wing tip or drop tanks and operation of lock mechanisms. To supply this power source, The Hymatic Engineering Co. Ltd. of England, has developed light weight, high thrust, pneumatic snap-jacks.

Each jack contains a built-in pressure bottle. Air at 3000 psi is stored in the hollow spindle of the jack and retained by a replaceable metal diaphragm situated in the piston. A 6 to 8 pound load on the operating piston will fracture the diaphragm to release air pressure which will extend a 3 inch stroke jack in 1/3 second. This compact unit is lighter and simpler than a separate air bottle, selector valve, cylinder and necessary piping.

Compressible Liquids

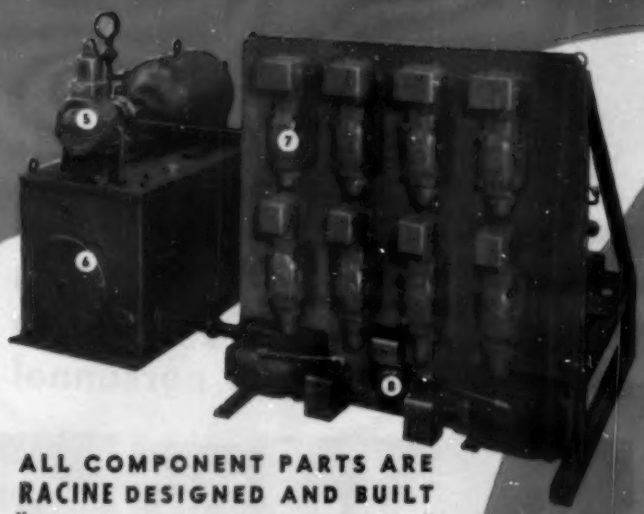
It has long been recognized that incompressibility of liquids is the basis for using liquids as a successful means of transmitting power. On many hydraulically powered machines the shock effect of compression has to be eliminated.

What would be the uses of a compressible liquid? A liquid spring could have many advantages over standard coil springs. The problem is to find a liquid that has suitable compressibility and to find a seal which would prevent leakage.

The Hydra Spring Division of the Wales-Strippit Corporation pioneered in this development. They had an important application. For years, they have built hole punching units used on blanking presses, which have been limited by the spring force available from standard coil springs. To get a greater market, they investigated liquid springs.

This investigation led to joint research with General Electric and DuPont. The technical cooperation resulted in a silicone fluid and plastic seal materials.

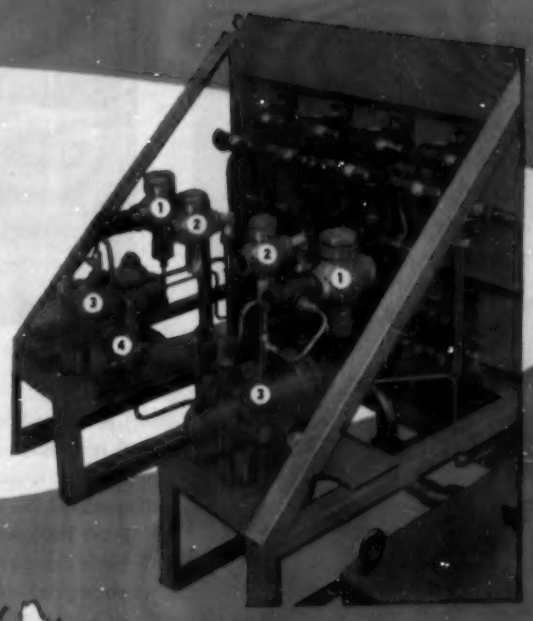
A Compact Hydraulic POWER HOUSE
one of many built by Racine for you . . .



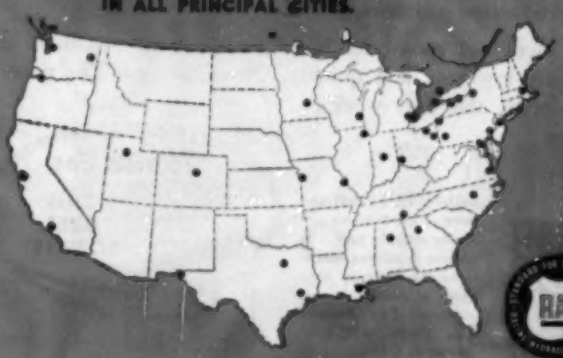
ALL COMPONENT PARTS ARE
RACINE DESIGNED AND BUILT
"They work better together"

RACINE
Variable Volume
OIL HYDRAULIC PUMPS

1. RACINE Pilot Operated Check Valves
2. RACINE Free Flow and Throttling Check Valves
3. RACINE Pressure Boosters
4. RACINE Sequence Valve
5. RACINE Variable Volume Pump
6. RACINE Oil Reservoir
7. RACINE Solenoid Controlled, Pilot Operated 4-way Valve
8. RACINE Solenoid Operated 2-way Valve

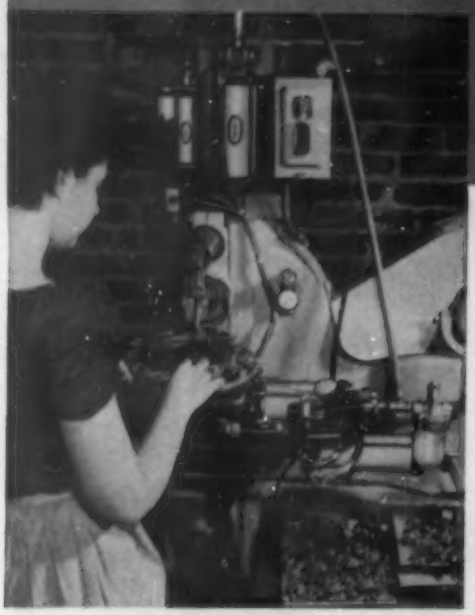


SALES AND SERVICE REPRESENTATIVES
IN ALL PRINCIPAL CITIES.



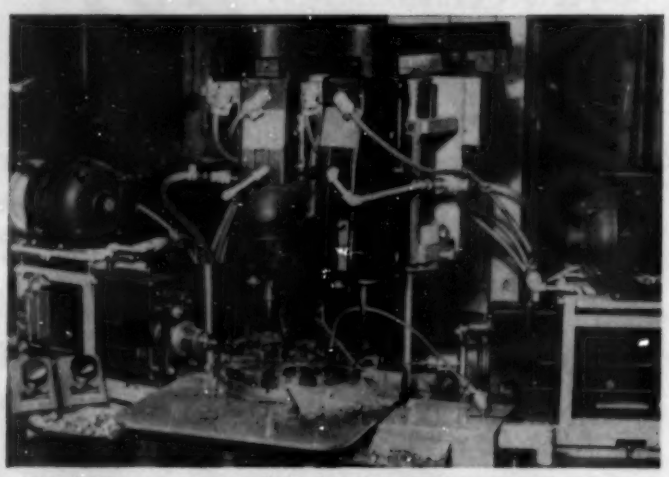
Racine Hydraulic Components Simplify any Hydraulic Circuit — "They Work Better Together." Write for complete Racine Hydraulic Catalog and the name of your nearest Racine Field Office. Complete Engineering Service Available. Address: **RACINE HYDRAULICS & MACHINERY, INC.**, 2074 Albert St., Racine, Wisconsin, U.S.A.

WITH THIS UNIQUE AIR MOTOR

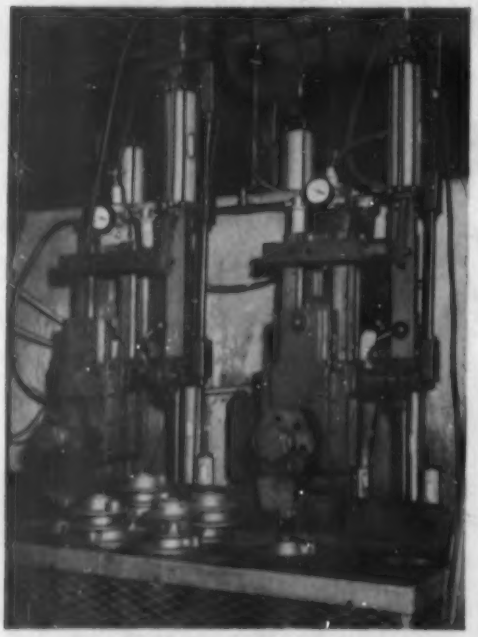


you can build cost-cutting special machines or modernize existing machines right in your own shop with your own personnel

This semi-automatic set-up at Eastman Manufacturing Co. doubled production and eliminated fatigue in milling bakelite magneto parts.



This drilling machine, built by Horrocks-Ibbotson, turned out 1 year's production of their fishing reel pawl blocks in 3 months.



A simple installation cut lathe time on steel ordnance parts from 90 to 10 seconds per piece at Joseph Pickard's Sons of Philadelphia.

Even for short runs you'll find special machines built around this versatile power unit will pay off in a big way — in greatly lowered costs, in fewer rejects, in better product quality. No expensive engineering is needed. In fact, your local Bellows Field Engineer may have in his Foto-Facts File basic designs that can be readily adapted to your product and your production processes.

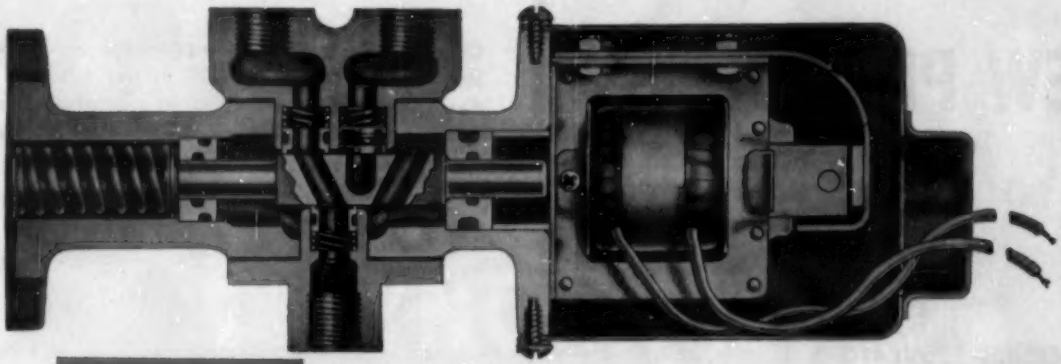
Your own tool room can build such special machines at decidedly low cost, and quickly. Often they pay for themselves with the first week's savings.

The Bellows Co.

IN CANADA: Bellows Pneumatic Devices of Canada, Ltd.
4972 Dundas St., W., Toronto, Ontario

Bulletin CL-50 tells the story of the Bellows Air Motor and the part it is playing in cutting manufacturing costs in hundreds of plants. Address: The Bellows Co., Dept. AH 654, Akron 9, Ohio.

817-A



Patent Pending

"Shear-Seal"

SOLENOID VALVES

FOR 250 P.S.I. OIL SERVICE

FOUR-WAY

THREE-WAY

SHUT-OFF

Competitive in every respect! The patented "Shear-Seal" principle, that has changed the concepts of extreme pressure control, is now available in this popular edition.

If solenoid valves are among the components of your product, and it needs a sales point in place of a trouble spot, you should get complete data on Barksdale "Shear-Seal" Valves.

Leakproof closure is retained for unbelievably long periods without maintenance, because "Shear-Seals" improve with the lapping action of each valve operation.

Dirt or foreign matter can't harm the sealing quality, because the sealing surfaces remain in constant intimate contact, even during actuation, and flow is through the "Shear-Seal", never across sealing surfaces.

Long trouble free solenoid and valve performance are the end result of the many inherent "Shear-Seal" advantages, well worth your careful consideration.

Write for bulletin 4S.

BARKSDALE VALVES

5125 ALCOA AVE., LOS ANGELES 58, CALIF

NEW PRODUCTS

Components, tools and equipment designed to improve operation of fluid power systems are described here . . . for more information fill in and mail the post card bound in this issue.

PRESSURE REGULATORS . . . for oil, air and water

Size: ¼, ⅜ and ½ in pipe with or without connections for pressure gauges.

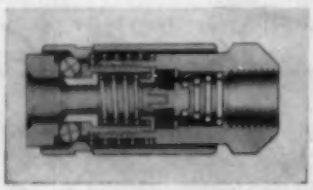
Design: Body parts are brass forgings permitting use of inlet pressure up to 400 psi, various

reduced pressure ranges are available. Screwed instead of bolted flanges, produces a strong compact design, the ¼ in size being only 2-3/16 in dia and 3⅝ in high overall. The valve is self aligning and fully guided, this allows maximum air flow with minimum pressure drop and gives long life. Metal diaphragms are used. This also allows the regulators to be used for compressed air, water or oil without change.

General Engineering Co., Newark 3, New Jersey
Circle 150 on Reader Service Card

QUICK AIR COUPLER . . . offers greater air flow

Features: Extra large air passage permits flow of 70 cu ft of free air per minute at 150 psi. Instant coupling action eliminates twisting or turning. Instantly couples, or uncouples with one push or pull. Automatic air check valve shuts off flow of air when coupler is detached



from nipple. Free swiveling of coupler on nipple prevents kinking of air hose. Coupler cannot be detached accidentally.

Lincoln Engineering Company, St. Louis 20, Mo.
Circle 151 on Reader Service Card

4-WAY VALVE . . . for double acting cylinders

Size: ¼, ⅜, ½ and ¾ in

Feature: Hand and foot operated 4-way valve with built-in full capacity, flow control meters of the Venturi type. An air and low pressure hydraulic valve, specifically designed for the control of

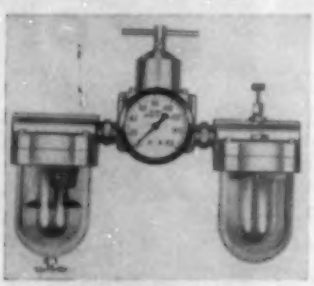
double acting air or hydraulic cylinders. Valves are built for heavy duty service and long operating life, featuring one balanced spool using renewable "O" ring type of packing. The flow control meters permit full line volume without volume loss of pressure. Line pressure variation will not affect valve function.

Application: Available for remote pilot operation, cam, single or double solenoid together with time delay features. Non-corrosive throughout, for air, oil or water in pressure range 0-150 lb.

Airmatic Valve, Inc., Cleveland 9, Ohio
Circle 152 on Reader Service Card

FILTER-REGULATOR-OILER . . . for stable air line pressure

Construction: Rugged construction and positive action of the



new piston cup design eliminates much of the wear factor common to conventional diaphragm valves and assures instantaneous response. This feature, coupled with line-sized orifices, provides maximum air flow with the least "line lag".

Features: The filter features a porous, sintered bronze filtering element which provides maximum air cleaning efficiency. Cone shaped for most effective filtering, the filter is easily removed for cleaning. An air baffle is provided as an integral part of

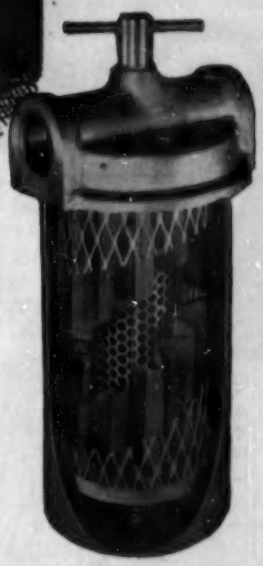
Continued on Page 16

Simplify Your Preventive Maintenance

SUMP TYPE (Cutaway)

with

MARVEL SYNCLINAL FILTERS



LINE TYPE (Cutaway)

For All Hydraulic Systems

SIMPLE EFFICIENT DESIGN REDUCES DEMAND ON YOUR SKILLED MAINTENANCE HELP

ANY WORKMAN can disassemble, clean and reassemble Marvel Synclinal Filters. Cleaning is done quickly, and Marvel's extra capacity requires less frequent cleanings. This means more production per machine with less man hours. Marvel protected machines spend their time producing, not in being serviced and repaired. Marvel's simple efficiency changes down-time to producing time.

STANDARDIZE WITH MARVEL

CHOICE OF OVER 400 ORIGINAL EQUIPMENT MANUFACTURERS

Improve your all-important preventive maintenance by simplifying it. Use Marvel Synclinal Filters throughout your plant. Specify Marvel on new machines, add Marvel to present machines. No moving parts to wear, nothing to keep in stock. Your first cost is your only cost.

A SIZE FOR EVERY NEED

Marvel Synclinal Filters, sump or line type, are available in capacities from 5 to 100 G.P.M. and choice of monel mesh sizes ranging from coarse 30 to fine 200.

IMMEDIATE DELIVERY!

Marvel not only delivers a top grade filter in both quality and performance, but delivers IMMEDIATELY! If desired, shipments are made the same day orders are received.

WATER FILTERS In response to the great demand we have adapted both our sump and line models for use in all water filtering applications. No changes have been made in the basic synclinal design.

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Meets J.I.C. Standards

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Marvel Engineering Company AH-6
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Without obligation, please send me complete engineering data on Marvel Synclinal Filters as follows—

Catalog #106 for Oil Filters
Catalog #300 for Water Filters

Name .....

Company .....

Address .....

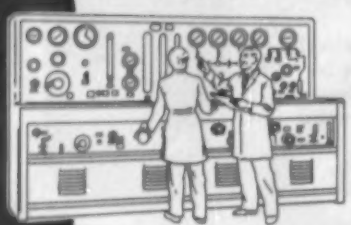
City..... State.....

The Better TEST MACHINES Bear this Trade Mark

When you see the "SPRAGUE" Trade Mark on a test machine, you can be sure of accuracy, efficiency, economy and years of dependable service.

SPRAGUE ENGINEERING & SALES CORPORATION GARDENA, CALIF.

In addition to the machines shown here, SPRAGUE makes Fuel Flow and Fuel Pump Test Stands, Heating and Ventilating Test Units, High Pressure Hose Testers, Air Operated Hydraulic Boost Pumps, Filters, Cylinder type Accumulaters (3,000 and 6,000 psi.), Gage Protector Automatic Shut Off Valves and other equipment. Write for information.



STATIONARY HYDRAULIC TEST STANDS

Tests aircraft hydraulic components, including engine driven pumps, at operating pressures up to 5000 psi. and with flows to 20 gpm. Provides multiple circuits to permit simultaneous testing of several units.

PORTABLE HYDRAULIC TEST STANDS

Standard units, 10 G.P.M. to 40 G.P.M. Motor or engine driven. For complete testing of aircraft hydraulic systems.

PRESSURIZED CABIN LEAKAGE TESTERS

Supply clean, filtered air under controlled pressure to locate leaks and determine leakage rate.

AIR OPERATED OIL DISPENSERS

Dispense clean, filtered oil simply, quickly, economically. One-man operation. Maximum safety.

FUEL BOOST PUMP TEST STANDS

Designed especially to test submerged fuel boost pumps. Tests both A.C. and D.C. types.

SPRAGUE

Engineering and Sales Corp.

1144 W. 135th Street

Gardena, California

New Products

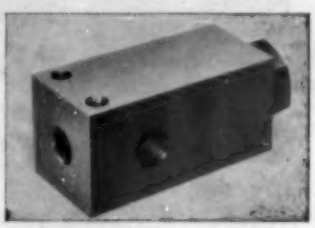
Continued

the filtering element. A brass drain cock permits quick removal of moisture and sediment. Offers accurate and stable line pressure regulation, controlled oil injection and efficient air filtering method.

Air-Mite,
Chicago, Illinois
Circle 153 on Reader Service Card

FLOW REGULATOR
. . . regulates flow to 3000 psi

Design: The regulator is a combination by-pass and restrictive type and can be used in systems



where older types of flow regulators were not satisfactory. It will hold the regulated flow as long as that much oil enters the inlet port. The excess between inlet and regulated flow is diverted to the by-pass port. The pressure at the by-pass port can exceed the regulated flow pressure without increasing the regulated flow.

Application: Valve will give preference to a power steering system and by-pass excess pump output, which in turn can be used to operate other hydraulic components. In many applications, it will eliminate the need for a separate steering pump.

Fluid Controls, Inc.,
Mentor, Ohio
Circle 154 on Reader Service Card

HAND FLARING TOOL
. . . has "open-end" design

Designation: Visi-flare
Size: For tube od's of ½, ⅝, ¾, ⅞, 1 in and 1¼ in.
Design: Consists of a body, a flaring pin and retaining spring. One piece machine steel body incorporates the bushing for the

Continued on Page 18

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Particularly when it comes to seamless steel tubing. For our modern, versatile plant is completely equipped to produce almost any type of cold drawn seamless tubing you may require—and produce it to *your* specifications. What's more, every Summerill tube is drawn to a smooth, bright surface, unusually free from pits, die scratches and scale—thanks to our step-to-step quality control and close inspection.

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CHEVRON* PACKING

Exclusive hinge-like construction assures a positive, low-friction seal

At every pressure—from the lowest to the highest—Garlock CHEVRON packing provides a positive, low-friction seal. CHEVRON is ideally suited for use on hydraulic cylinders (both single-acting and double-acting), hydraulic rams, plungers of pumps and other reciprocating rods.

The exclusive hinge at the apex of each ring makes this packing flexible and sensitive to pressure changes. When the pressure is on, CHEVRON packing seals firmly both on the inside and outside edges. When the pressure is off, CHEVRON packing maintains a positive seal yet allows the ram or rod to return without binding. This automatic action not only prolongs the life of the packing but also increases the efficiency of the equipment on which it operates.

That is why many manufacturers of hydraulic cylinders, jacks, lifts and presses use Garlock CHEVRON packing exclusively.

Whether your job is plant maintenance or manufacturing new equipment, ask us about CHEVRON packing—the exclusive product of Garlock's own factories. Garlock CHEVRON packing is available in many materials such as: cotton duck with rubber or neoprene binder, asbestos with rubber or neoprene binder, hycar, "Teflon," and "Kel-F."

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK
In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.

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GARLOCK

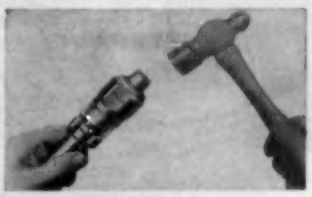
PACKINGS, GASKETS, OIL SEALS,
MECHANICAL SEALS, RUBBER EXPANSION JOINTS

New Products

Continued

hardened steel flaring pin. Hexagon body provides a good grip for the user and prevents the tool from rolling off the bench or flat surfaces.

Features: Working end of the tool is exposed, permitting the user to observe the entire flaring operation. This feature elimi-



nates intermittent inspection and the "trial and error" procedure.

Application: Light, compact, the tools range in weight from .23 to 1 lb, making them "pocket-size" for convenient installation and maintenance of tubing systems. The tool is designed for rapid, easy formation of J.I.C. and S. A.E. hydraulic standard 37 degree flares on copper, aluminum alloy, fully annealed steel and stainless steel tubing.

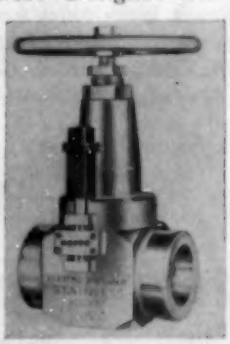
The Parker Appliance Company, Cleveland 12, Ohio

Circle 155 on Reader Service Card

SHUT-OFF THROTTLE VALVE . . . solenoid operated

Sizes: 2 to 20 in

Features: Designed for high



temperatures and pressures. The throttle valve is operated by the solenoid valve attached to the side. The solenoid valve has two solenoids, one for opening, the other for closing. A momentary

Continued on Page 20

HYDRAULICS FOR MOBILE EQUIPMENT
VOL. 2

Mobile Equipment News

VICKERS INCORPORATED, DETROIT, MICHIGAN

IMPROVES PERFORMANCE • CUTS COSTS
NO. 4

VICKERS® VT16 PUMP NOW AVAILABLE FOR HYDRAULIC POWER STEERING OF TRUCKS AND MATERIALS HANDLING VEHICLES

The Vickers Series VT16 pump is used more widely than all other makes combined for the power steering of automobiles. It is now available for the first time for the hydraulic power steering of trucks and materials handling vehicles. It has all the characteristics important to this service and is used in a separate hydraulic circuit for steering only.

COMPLETE PACKAGE

Series VT16 has integral volume control valve and relief valve . . . also an integral oil reservoir. This is a complete hydraulic power package for steering.

SIMPLIFIED INSTALLATION

This compact and complete power package is easily and quickly installed. All you need to do is bolt it on, make two hydraulic connections, and couple the power.

LONGER PUMP LIFE

The exclusive Vickers "Hydraulic Balance" eliminates pressure-induced bearing loads and the consequent wear. These lighter bearing loads mean much longer bearing and pump life.

NO LOAD STARTING

At rest and normal starting speeds, the sliding vanes are retracted; only after engine fires do vanes extend and pumping begin.

ASK FOR BULLETIN M-5104A

Series VT16 Vickers Pump with integral volume control and relief valves and oil reservoir. For hydraulic power steering.

HIGH OPERATING EFFICIENCY

The vane type construction, hydraulic balance and automatic maintenance of optimum running clearances enable these pumps to deliver more oil with less power. This high operating efficiency is maintained throughout the long pump life.

Series VT17 Vickers Pump is similar to the VT 16 except that it does not include the oil reservoir.

VICKERS Incorporated
DIVISION OF THE SPERRY CORPORATION
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Application Engineering Offices: ATLANTA • CHICAGO (Metropolitan) • CINCINNATI • CLEVELAND • DETROIT • HOUSTON • LOS ANGELES (Metropolitan) • NEW YORK (Metropolitan) • PHILADELPHIA (Metropolitan) • PITTSBURGH • ROCHESTER • ROCKFORD • SEATTLE • TULSA • WASHINGTON • WORCESTER

VICKERS HYDRAULIC POWER STEERING BOOSTER

EFFORTLESS • POSITIVE • SHOCKLESS

6726

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

Circle 121 on Reader Service Card

Warner SEQUENCE VALVES

Warner Sequence Valves, designed for any system pressure up to 3000 psi, are adaptable to a wide range of hydraulic applications. These economically priced valves have low leakage and low operating force characteristics.
SOMETHING MORE THAN ACCURACY

Precision machining ability involving special lapping techniques to hold extremely close tolerances is only a part of the story behind Warner Hydraulic Equipment.

For many years Warner has specialized in the design, development and manufacture of precision hydraulic equipment. As a result of this comprehensive experience Warner is well qualified to assist you in the development of special hydraulic equipment to meet your particular requirements.

* We invite you to utilize Warner's specialized experience in the field of hydraulics by giving our engineers and laboratory technicians an opportunity to work with you in the early stages of design and development.

Send today for your copy of an illustrated folder describing typical examples of Warner Hydraulic Equipment.

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New Products

Continued

contact holds the valve in either an open or closed position. Permanent magnets in the upper part of coil housing hold the pilot valve open. When one of the solenoids is energized momentarily, it will pull pilot valve down and close solenoid valve, which in turn closes the throttle valve. Throttle valve will close quickly until it is almost fully closed then slow up, so as to avoid a water hammer.

Hoppe Engineering Company, Inc., Greensboro, Indiana

Circle 156 on Reader Service Card

FLEXIBLE V-RING

. . . uses less space

Designation: Super-Thin

Design: Teflon rings for pumps, valves and all types of packing, are flexible, with a cross section as thin as .015. The added resili-

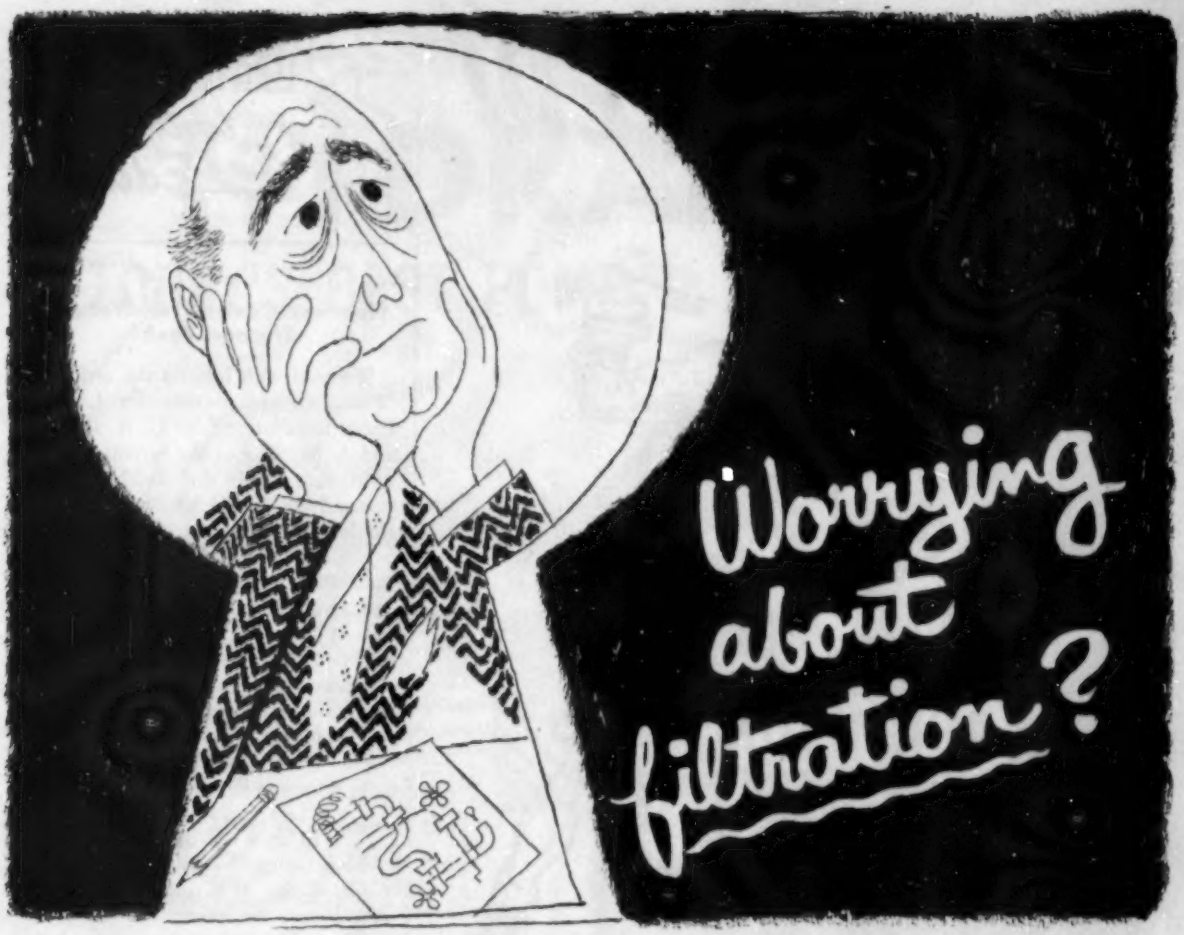
ency makes possible a tighter seal at lower pressures. The rings make possible the design of smaller and lighter units by reducing the packing gland length and diameter. A production line item. They can be installed in existing units. Made of solid Teflon, they are chemically inert, suitable for use in temperatures from −150 to +550 and have a natural slipperiness that reduces friction.

Features: The resilience of the rings is such that even low pressures exert a flattening action, forcing the cone shaped segments to bear outward against the wall and inward against the shaft with sufficient pressure to maintain a seal, yet creating the least possible friction.

Reid Enterprises, Los Angeles 58, Cal.

Circle 157 on Reader Service Card

For more NEW PRODUCT reviews turn to page 100



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. . . always ready to serve you!

Your filter problems—small or large—are always welcome at Purolator's Engineering Department.

If you find that none of the nearly one thousand types of standard Purolator* filters will fill the bill . . . we'll design one especially for you!

But before you decide on a custom-designed unit, you'll want to study the many kinds of Purolators available on order. The large, illustrated Purolator catalogs are yours for the asking. Just mail us the coupon, indicating which ones you wish.

Whether you need one special filter, or a million of a kind . . . your best source is *Purolator!*

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There's a PUROLATOR for every filter need

Lube oil	Air	Foods	Adhesives
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Hydraulic Fluid	Pharmaceuticals	Paints	Beverages
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PUROLATOR PRODUCTS, INC.
Rahway, New Jersey and Toronto, Ontario, Canada
Factory Branch Offices: Chicago, Detroit, Los Angeles

PUROLATOR
WORLD'S FINEST OIL FILTER

Here's the KEY to your filter problems—

Purolator Products, Inc., Rahway, N. J.

Send the following Purolator catalogs:

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UNDEFEATED!

AND

STILL CHAMPION

CAN YOU SUPPLY A CHALLENGER?

. . . That difficult fluid, gas, or air transmission problem in your plant—We'll send you a Snap-tite Hi-Flow quick connect disconnect coupling with or without automatic shut-off in any size 1/8" to 3"—Test it in your plant, under actual working conditions—You be the judge—If it doesn't solve your problem or do a better job than the coupling you are now using, ship it back collect—Write today on your letterhead, briefly outlining your problem—We'll ship immediately.

Snap-tite INC.

201 S. Rockwood, Union City, Penna.

LETTERS to the Editor

Floatless Control for Water Storage Tank

We read with interest the article, "Pump Control System for Large Press Installation" by C. B. Blake and A. M. Steel of the Scovill Manufacturing Co. in the March, 1954, issue of APPLIED HYDRAULICS. Could you advise us if there is a probe similar to the type described that could be used on underground water storage tanks. Would you advise if this type of control can be supplied by any of the accumulator manufacturers for air bottle accumulators using water.

F. DANDY,
Plant Engineer,
Stokes Division,
The General Tire and
Rubber Co. of Canada, Ltd.

These questions were referred to C. B. Blake, from whose letter to Mr. Dandy we quote:

The electrical components for the floatless control of the water storage tank described in the article were furnished by B/W Controller Corp., 220 East Maple Road, Birmingham, Mich. This company can furnish the complete system, including the probes, as a standard package. In our installation we were dealing with pressures up to 5000 psi and since no probes were available to seal an air-water accumulator at that pressure, we designed the probes and purchased the electrical components.

Limit Switch Operated Flow Control Valve

Can you advise if it is possible to obtain a solenoid operated flow control valve (up to 300 psi) which can be activated by limit switches, to do double duty of controlling feed and rapid traverse flow (hydraulic). To clarify, we would like to have a valve which can be preset to desired feed flow, controlling the

Continued on Page 25

FOR PRESSURES UP TO 5000 P.S.I.

HYDRAMITE

IS TODAY'S BEST PUMP... AND COSTS LESS

IN THE FEW YEARS since the Hydramite Pump was introduced it has become the top choice for an ever-increasing range of hydraulically-operated equipment... and has unfailingly brought the efficiency and economy which are always associated with products of the American Engineering Company.

The Hydramite Pump is available in a variety of sizes... develops pressures up to 5000 p.s.i. It operates on any of the makes and viscosities of oil which are suitable for hydraulic circuits.

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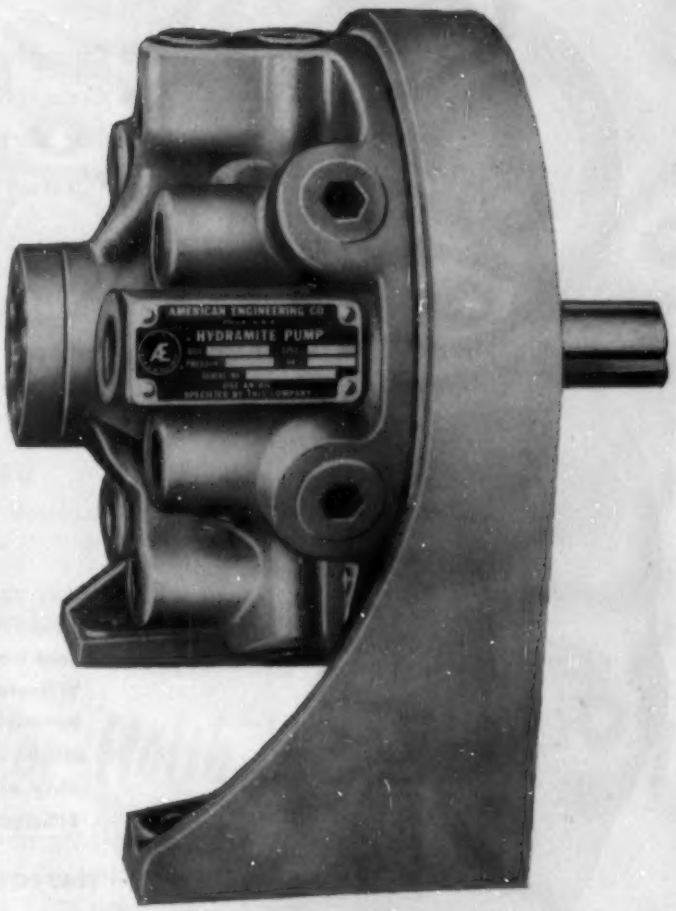
Write for folder giving full information on the unique Hydramite Pump... and call on AE engineers or representatives for recommendations regarding possible applications.



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DETROIT, MICH. . . . . *726 Lothrop Avenue, TRinity 1-6363*
DOWNEY (Los Angeles Co.), CALIF. . *11634 Patten Rd., TOpaz 2-8166*
MILWAUKEE, WIS. . . *647 West Virginia Street, BRoadway 1-3234*
NEWARK, N. J. . *Suite 814, 1180 Raymond Blvd., MItchell 2-7586*
REDWOOD CITY, CALIF. . . *Broadway and National, EMerson 6-3861*
WICHITA, KANSAS . . . . *519 South Broadway, WIchita 3-6971*

Letters to the Editor

Continued

speed of a cutting tool, for feed of tool. For rapid traverse and quick forward or reverse passage, prior to feed speed, such a valve would be capable of opening to full flow area, permitting maximum cylinder speed. Do you know of such a valve and where it might be obtained?

WALTER W. GREEN,
Pittsburgh 28, Pa.

The flow control circuit which you describe is common to many machines in industry. There is, however, no single valve which will give rapid traverse and then feed. Rapid traverse and automatic feed are easily accomplished by using a standard flow control valve in parallel with a solenoid operated shut-off valve. Limit switch actuation will change cylinder speed from feed to rapid traverse or rapid traverse to feed in any combination desired by setting the switch trip dogs. It is very simple to prepare such a feed circuit using separate valves. One or more valve manufacturers can supply a valve panel in which the necessary valves are grouped in one housing; this may be the type of component you have in mind. We have forwarded a sketch of a meter-out flow control circuit which can be used to control the feeding of a drill or a milling machine table, or possibly, the application you have in mind. We suggest that you contact Mr. Robert Wagner of the Weinman Pump Company, 317 South Main St., Pittsburgh 20 for further assistance.

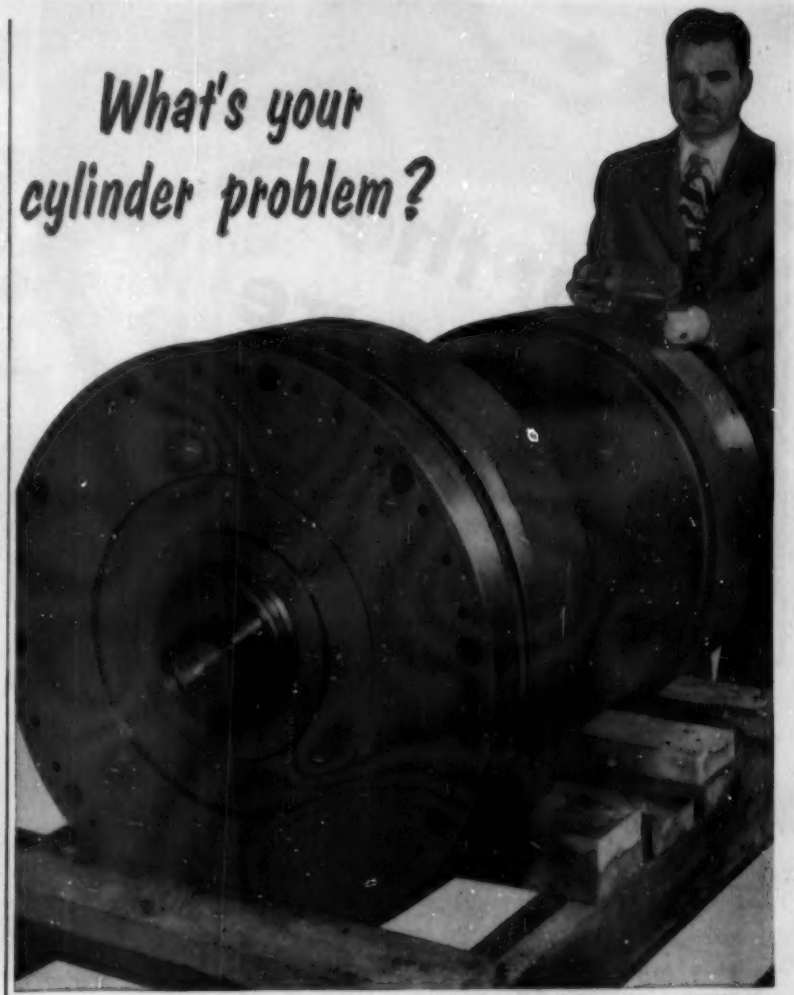
Special 3-way Low Pressure Air Valve

Do you know of a manufacturer that makes a 3-way valve in which any two ports can be interconnected and the third blocked, the valve to incorporate soft seats. Service is air at atmospheric temperature and ½ psi. A plug valve with soft seats, and T ported might do it.

JOSEPH B. WILEY, JR.
Hummel Technical Products, Inc.

The very low operating pressure requirement for a 3-way air valve would probably make it impossible to get an "off-the-shelf" item. How-

Continued on Page 26



Big one: Anker-Holth Rotating Hydraulic Cylinder with 21" bore and 20" stroke, for 3000 psi. Little one: Anker-Holth Air Cylinder with 3" bore, 3" stroke.

Anker-Holth has the answer!

• Your problem in power motion may be far removed from the Anker-Holth Cylinders shown above. Whatever your need for air or hydraulic cylinder power, Anker-Holth has the engineering know-how and manufacturing facilities to match your specific requirement. Anker-Holth engineers will gladly assist you. Call or write Anker-Holth Division of The Wellman Engineering Company, Dept. C-12, 2723 Conner Street, Port Huron, Michigan.

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ENGINEERED CYLINDER POWER
WELLMAN

FREE on request... bulletin on complete line of Anker-Holth products.

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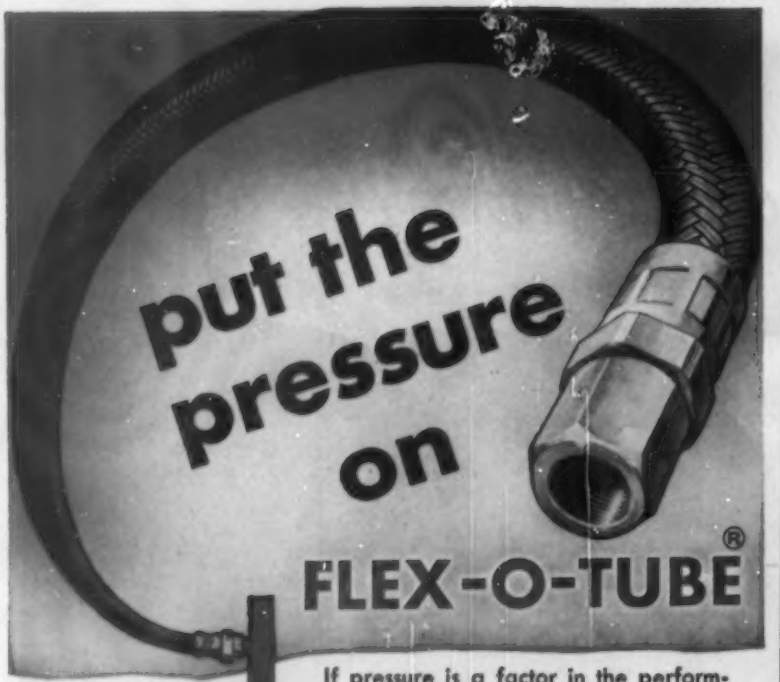

If pressure is a factor in the performance of your product, you can rely on Flex-O-Tube. For here is a name that has stood for uniformity of high quality for twenty-five years.

And just as important, the Flex-O-Tube organization is one that you can rely on, too. When the pressure's on for production you can count on prompt deliveries of flexible hose products that consistently meet specifications.

These are but two of the reasons why industry has used miles and miles of Flex-O-Tube and continues to specify it in increasing quantities. Why don't you find out for yourself by "putting the pressure on Flex-O-Tube"?

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Flex-O-Tube will help you determine the assembly needed or work to your own specifications. In either case, modern facilities and latest inspection techniques assure you a uniformly high quality product delivered promptly.

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Flex-O-Tube hose is also supplied in bulk coils with reusable fittings for field assembly. Complete range of sizes and types.

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DIVISION OF MERIDAN CORP.

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Letters to the Editor

Continued

ever, most of the air valve people we checked state that they could probably supply a valve that would not leak at this pressure. We suggest you send your requirements to Ross Operating Valve, Hannifin, Valvair or C. B. Hunt.

Reprints of the 32 page circuit section which appeared in January are available. Single copies 50c; 40c in lots over 50; 35c in lots over 100.

Hydromotor Torque Actuator

Our inquiry of February 16th, published in the April issue of APPLIED HYDRAULICS, unintentionally carries the implication that we are looking for a source of supply to provide us with torque actuators in competition to those produced by the Hydromotor Division of The Bonnot Company. This misunderstanding is due to the unfortunate wording of our inquiry; we intended only to scan the field for possible competition. You will be interested to know that we represent the Hydromotor Division in the Northern California territory; we have a considerable number of these units working in this area with complete success and we look forward to the sale of many additional units.

E. C. DITZEN,
Ditzen Engineering & Sales Co.

We are pleased to publish the above comments by Mr. Ditzen to clear up any possible misinterpretation of his original letter.

Small Capacity Flow Control Valve

We should like to know if you can refer us to a company that manufacturers a flow control valve of very small capacity suitable to a working pressure of 2000 psi. The capacity range will be from 0 to 20 cu. in. per min. We are familiar with flow control valves which have a maximum flow of 1/3 gpm and a minimum metered flow of 4 cu.

Continued on Page 30

Here's how this strainer "combs" itself clean!

This simple chalk test shows how AUTO-KLEAN's unique built-in comb construction cleans the strainer without costly interruption of flow

ORDINARY BLACKBOARD CHALK leaves heavy deposit of chalk particles on and between discs of Cuno AUTO-KLEAN strainer.

TURNING HANDLE ONE REVOLUTION moves strainer element through comb blades, removing all traces of chalk from between discs. Cuno's exclusive combing operation cleans *thoroughly* —without stopping flow.

FILTERING AREA IS COMPLETELY CLEAN, restoring full initial capacity. All chalk particles and dirt fall to bottom of housing where they can be drained periodically.

- AUTO-KLEAN's permanent metal filter element is available in steel, brass, or stainless steel for long, trouble-free service.
- AUTO-KLEAN is adaptable to any fluid-flow system.
- From acids to tar . . . if you can pump it, Cuno can filter it. Capacities range from one gallon per hour to 15,000 gallons per minute.

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ENGINEERED FILTRATION

Removes More Sizes of Solids From More Kinds of Fluids

AUTO-KLEAN (disc-type) • MICRO-KLEAN (fibre cartridge) • FLO-KLEAN (wire-wound)

SINGLE-STRAINER FLUID PROTECTION FOR HYDRAULIC SYSTEMS

Continuously cleanable AUTO-KLEAN eliminates need for stand-by strainers

AUTO-KLEAN's compact construction gives users positive solids-from-fluid separation in space which would limit ordinary filters to by-pass service. The low pressure drop operation of AUTO-KLEAN strainers enables you to have full-flow service on gravity, low pressure, high pressure or suction lines—with no loss in operating efficiency.

Cuno's exclusive "comb-clean" action provides *complete* cleaning of the filter element—without stopping fluid flow. Thus, there's no need for a stand-by strainer.

The low maintenance costs of AUTO-KLEAN save you money, for there are no cartridges to change. An occasional rotation of the handle does the cleaning job (most units can be equipped with motor-drives for continuous cleaning).

Fixed-space metal discs in this modern strainer effectively remove all solids larger than the specified disc spacing—from .0035" up to .062".

For permanent, positive hydraulic system protection, install compact Cuno AUTO-KLEAN—the precision-built strainer. Send the coupon for bulletin.

A.3.5

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Circle 32 on Reader Service Card

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The success of R/M Vee-Flex lies in its special design, by which pressure from the medium being packed transmits itself through the packing to produce positive sealing against the stuffing box wall and rod. This is accomplished by R/M's unique convexly curved surface on the pressure side of the packing. Photoelastic analyses,* corroborated by radial pressure tests,* prove that maximum sealing performance occurs at a point slightly below mid-width on the sealing area.

For packing pumps, valves, rams, presses, cylinders, accumulators or other hydraulic equipment, R/M has Vee-Flex Rings to meet your most exacting requirements. For example, there are five different types to seal against pressures in excess of 6000 psi. Different types are available for air, gas, steam, oil, water, food products, etc. Write for R/M Vee-Flex Bulletin giving complete data and table of sizes.

*Performed at the *Franklin Institute Laboratories for Research and Development*

Simplified diagram of stress trajectories in R/M Vee-Flex Rings with convexly curved surfaces.

Simplified diagram of stress trajectories in V-type rings that have flat contact surfaces.

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The technical training, experience, and resourcefulness of O-M Field Engineers is available to any manufacturer who has an Air or Hydraulic application problem.

In many cases the recommendations of these specialists result in improved design, more efficient machine performance and economies in production.

The O-M Field Engineer in your area would welcome an opportunity to discuss your Air and Hydraulic applications with you on an engineering level, in your plant. Simply contact any of the O-M Representatives listed in this advertisement or mail the coupon below. No obligation, of course.

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POWER That's Dependable

POSITIVE CONTROL
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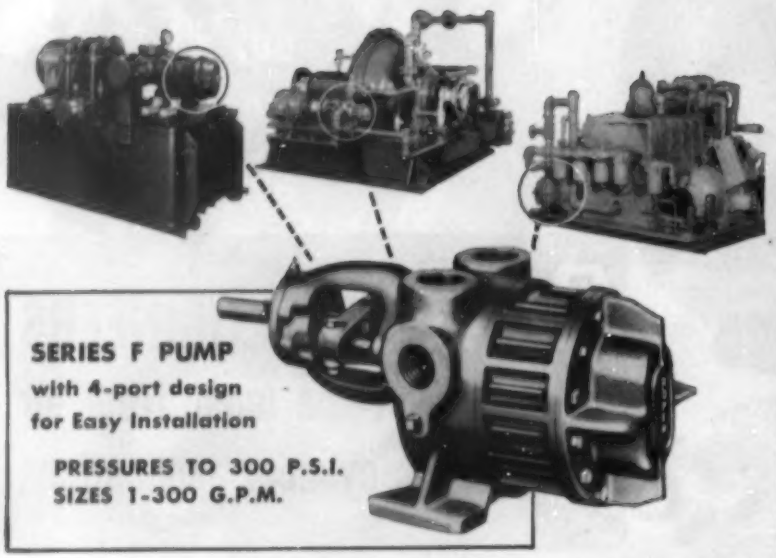

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PRESSURES TO 300 P.S.I.
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Please send copy of your latest catalog and new booklet "How To Solve Pumping Problems".

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ADDRESS.....

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Letters to the Editor

Continued

in. per min., but these valves are somewhat unstable in the lower part of their range.

ANTHONY R. PATTERSON,
Plant Engineer,
Raybestos-Manhattan, Inc.

We do not know of a manufacturer who can supply a flow control valve which has a variable range from 0 to 20 cu. in. per min. Perhaps one of our readers may have a suggestion. The reason for the unstability of the valves you mention in their lower ranges is that viscosity changes are very critical and any leakage in any part of the circuit greatly influences the output from the flow control valve. To meter a very small flow, the very small orifice required would very easily plug. For this reason, we doubt if a very small flow could be metered accurately for a reasonable service life.

Air-Oil Heat Exchangers

Kindly supply us with names of manufacturers of air-hydraulic oil heat exchangers.

K. C. DENNIS,
Mechron Engineering Products, Ltd.

We are sending you a tear sheet from the January 1954, Directory issue of APPLIED HYDRAULICS listing the manufacturers of heat exchangers used in the oil hydraulics field.

Hydraulic Baling Presses

We are interested in obtaining the names and addresses of the manufacturers of hydraulic scrap baling presses which do not use triplex pumps.

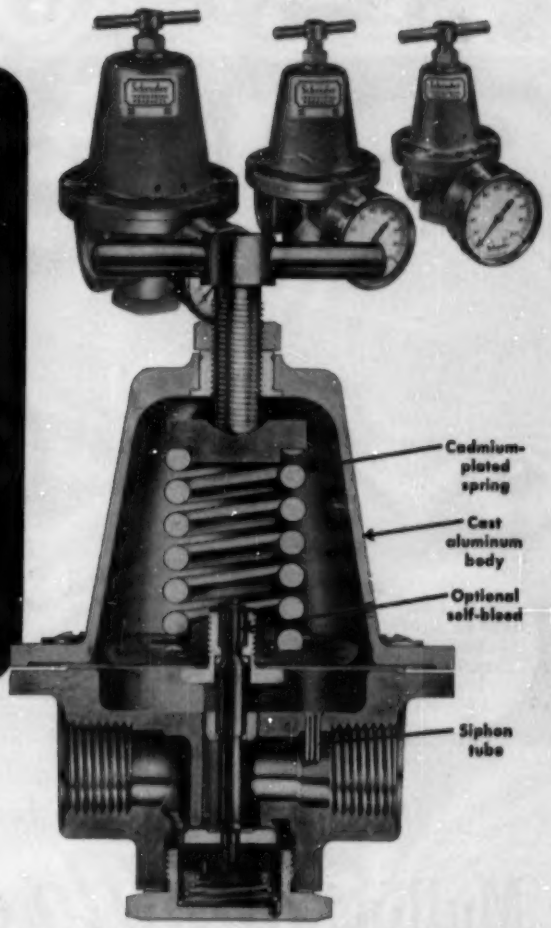
ALLAN M. STEEL
Scovill Manufacturing Company
Waterbury, Conn.

We have sent you the names of several companies. However, to our knowledge, standard metal scrap balers use triplex pumps. Several of the companies we have suggested will probably be willing to supply any suitable power system you desire.

Continued on Page 34

The New Schrader Air Pressure Regulator

NOW... get
–maximum capacity
–fastest response
–minimum pressure drop



Large ports and straight-through design of these new Schrader Regulators give you maximum capacity with minimum pressure drop—and, at the same time, response that is almost immediate to changing demands.

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The regulator can be installed for flow from right to left ... left to right ... or vertically in either direction. It may be mounted right side up or inverted. The pressure gauge may be installed front or rear.

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Please send me details on the new Schrader Air Pressure Regulator.

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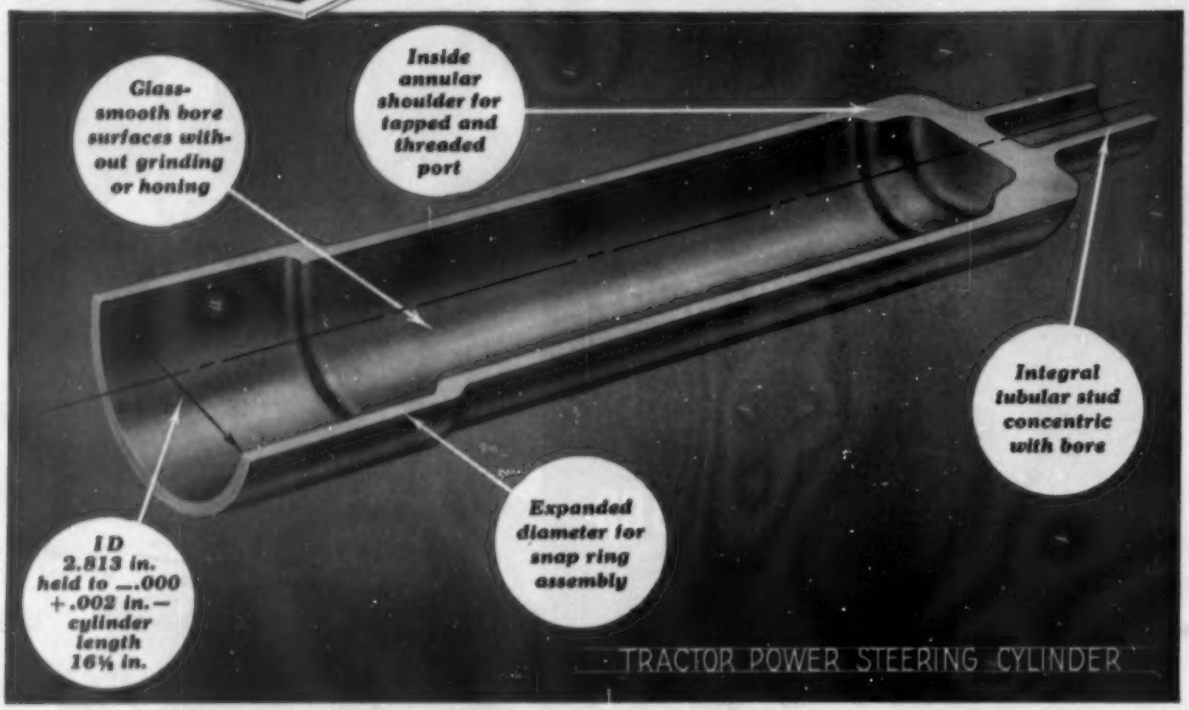
Now Mullins Koldflo makes your dream design practical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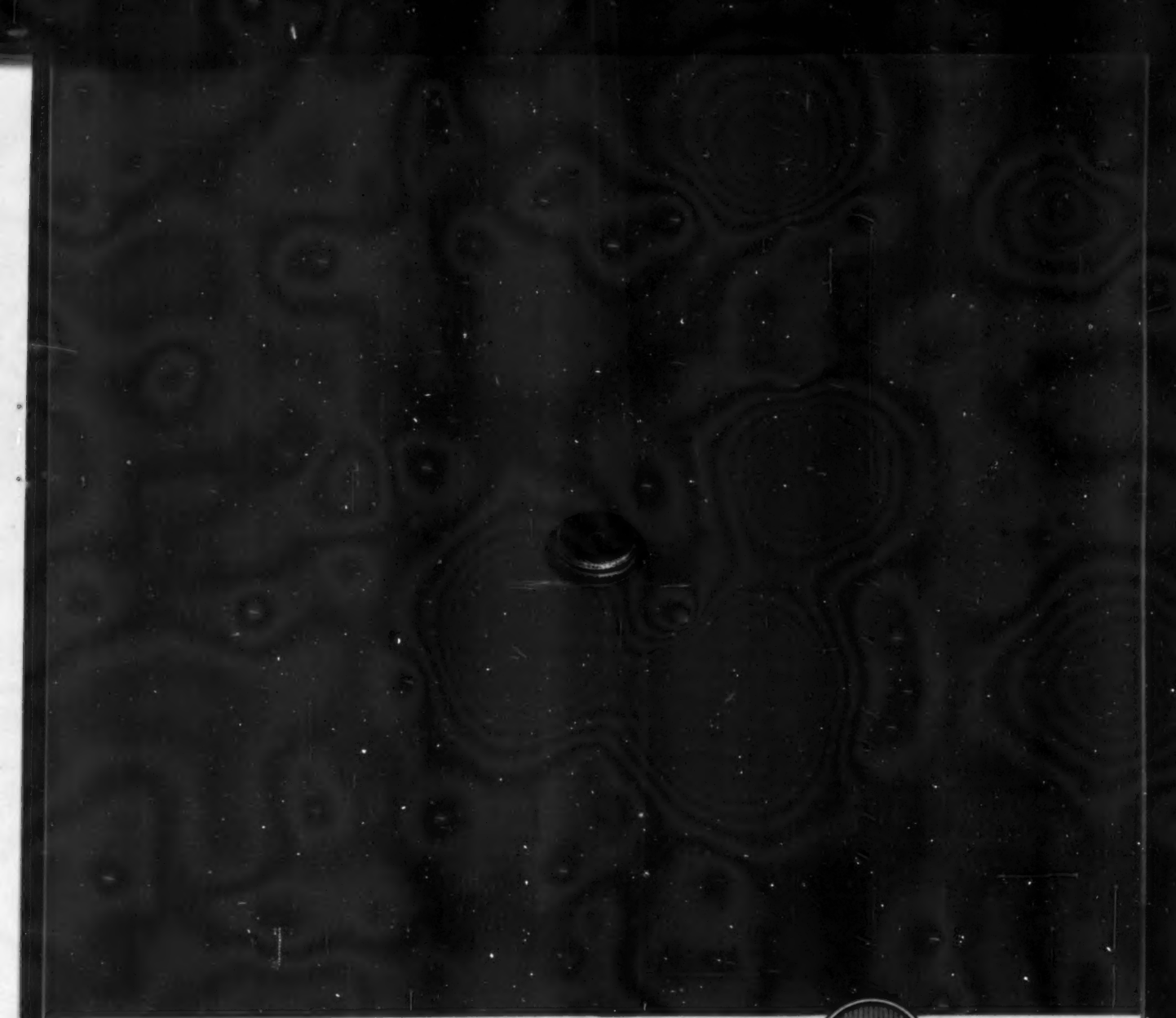

TINY BUT VITAL This little dust boot protects the ignition interrupter switch that shifts gears in automatic auto transmissions. It does that vital job dependably. Like all C/R Sirvene (synthetic rubber) parts, (many are smaller, hundreds are bigger) everything about it is special: design, compounding of oil-resistant elastomers, molding, and quality control of quantity production. Also, it is symbolic. It symbolizes how C/R engineers can serve you, in developing pliable mechanical parts for your own critical applications. Our book, "Engineering with Sirvene" will tell you all about C/R service. Just write us, and we'll send your copy promptly.

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Solve Shock Problems On Your Drawing Board

U. S. Patents under Olaer Licenses

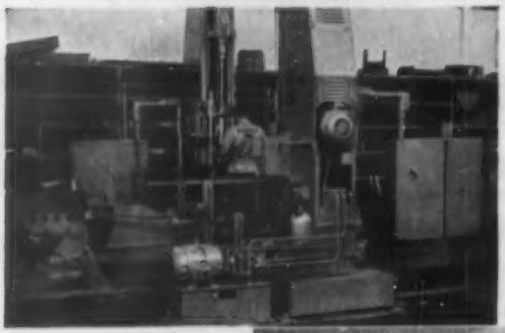
Design Greer Accumulators into Your Hydraulic Circuits

Pulsations from powerful pumps...chatter and fluctuations in machine tool table travel...water hammer from rapid operation of by-pass valves are a few of the serious shock problems faced by design engineers. The answers have not always been successful.

But today, there *is* a solution to these chronic problems, as certain as it is simple. One or more Greer Accumulators tied into the circuit at critical points, *will* control shock. The high surge of system fluid, which causes shock, is cushioned by the easy compressibility of the gas-filled bag inside the accumulator (see drawing on left).

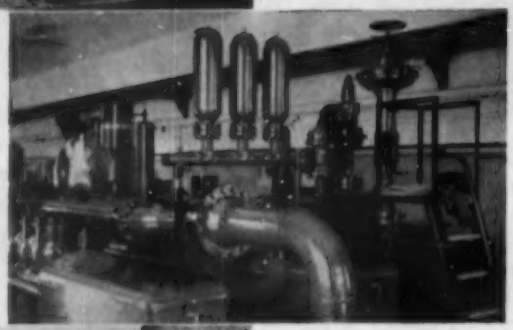
Let our experienced application engineers discuss with you and demonstrate the effectiveness of Greer Accumulators in solving shock problems.

Here Are Greer Accumulator Applications That Solved Shock Problems



For Machine Tools. Honing machine suffered severe shock each time honing spindles were reversed causing costly work spoilage. Solution: Greer Accumulators reduced shocks, making them harmless. Write or call for Bulletin 301.

For Pipelines. These six Greer Accumulators cut pump pulsations 53%. Pipeline and pump breakage was reduced from once a month to zero. Pressure surges from valve closures are absorbed in similar manner. Write or call for Bulletins 500 and 600.



For Construction Equipment. Bucket loader shock slowed machine, tired operator, caused parts to fail. Greer Accumulator, mounted on machine, cushioned shock and upped profits. Write or call for Bulletin 700.

GREER HYDRAULICS INC. · 454 EIGHTEENTH STREET, BROOKLYN 15, N. Y.

Field Offices in Chicago, Dayton and Detroit • Sales representatives in all principal cities

Letters to the Editor

Continued

Automatic Air Bleeder in Hydraulic Systems

Please send me any information you might have on the automatic bleeding of air in hydraulic systems. On page 62 of the June, 1953, issue of APPLIED HYDRAULICS, Figure 1 shows a cross section of a bleeder valve which is of particular interest to me. I am especially interested in a valve capable of accommodating from 2 to 10 gpm.

VAL A. MAYER,
Assist. Chief Engineer
Barry-Wehmiller Machinery Co.

There are very few sources for an automatic air bleeding valve for use on hydraulic systems. We would like to suggest that you write Mr. Milton Adler, 3857 Kings Highway, Brooklyn 34, New York. We understand that this valve, originally designed for automotive hydraulic brake systems, may be marketed for industrial applications. Vickers-Armstrongs, Ltd., Elswick Works, New Castle-upon-Tyne, England, manufacture an air bleeder valve which may be suitable for your application. Greer Hydraulics, Inc., 454 18th St., Brooklyn 16, New York, have recently introduced a semi-automatic bleeder valve which may be of interest to you.

Hydraulically Operated Robot

About two years ago you published details of a display model robot operated hydraulically. We would be interested in building a similar unit as a part of our display of hydraulic equipment in a machine tool show in Sydney. Unfortunately we cannot locate this copy. Could you send us a copy or put us in touch with the makers of the robot?

E. S. ARCHER,
C. S. Archer Pty., Ltd.,
Stanmore, N.S.W.,
Australia

The story you refer to on the hydraulically operated robot was run in the June, 1952, issue of APPLIED HYDRAULICS under the

Continued on Page 44

WANTED

AN ENGINEER—

who is having trouble working out a problem involving hydraulics.

This message takes only two minutes to read but may save you endless hours of hard work.

You know that the functions that play so important a part in any new mechanism are almost never outside the realm of someone else's thought or experience. Whether it be a servo-mechanism, a distinctive type of traction drive, an unusual motion or sequence of operations, the probability is: Hydreco engineers have either rubbed shoulders with the problem or actually worked it out!

Endless hours of concentration in finding the answer is hardly a virtue — if a simpler, more direct, proven solution is to be had. Management may admire long, studied application to a project, but appreciates a quick result much more.

Hydreco engineers, with years of intimate contact with all manner of problems involving hydraulics, represent a rich reservoir of factual information, experience and "savvy." They'll share it with you without cost or obligation on your part. Many of the products of America's top manufacturers are the result of such cooperation. There are many others which are simply project numbers today.

So, if you are stymied, puzzled or just need a fresh approach, write today.

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THE NEW YORK AIR BRAKE COMPANY
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HYDRECO DIVISION
THE NEW YORK AIR BRAKE CO.
1104 East 222nd St.
Cleveland 17, Ohio

Without cost or obligation of any sort, I would like to discuss a problem in confidence with a Hydreco engineer.

Name.....

Company.....

Address.....

City.....Zone.....State.....

USEFUL LITERATURE

You'll find many valuable production and design ideas in publications described here . . . copies will be sent you free without obligation

HYDRAULIC CYLINDERS AND VALVES . . . Pathon Manufacturing Co. has released Bulletin No. 22 on this subject. Here is a 32 page presentation in color which covers many products. Some of which are 1000 psi and 2000 psi cylinders, directional control valves, rams and mounting brackets. All features are discussed at length. All pertinent dimensions are given for cylinders for each of the cylinder bores available. Outline drawings are included for each model cylinder. Information is also included on oversize rods, rod wipers, rod wrench flats, connecting eyes and chrome plated and hardened rods. A cross section view shows the construction of the cylinder. Selector chart for valves assures proper unit for the application.

Circle 200 on Reader Service Card

TIMERS . . . a vital part in modern industries new trend to automatic manufacturing is the subject of a new 12 page booklet, Form 354 released by Eagle Signal Corporation. The subject of automation is discussed. Many of the company's products used in solving the problem of relating and coordinating machines and processes automatically, are completely described. Several reset timers and repeating cycle timers are illustrated and the features and operation of each are given.

Circle 201 on Reader Service Card

AUTOMATIC TRANSFER SWITCH . . . In publication No. 502, issued by Automatic Switch Co. necessary factors are outlined that should be observed whenever proper selection of this type switch is to be made. The pamphlet takes up items such as continuous duty rating, single throw vs double throw, quiet operation, full relay protection, operating speed and many other pertinent facts. The literature includes wiring diagrams and photos.

Circle 202 on Reader Service Card

"O" RINGS . . . A new 12 page brochure which gives detailed information on compounds, groove dimensions and sizes has been published by Goshen Rubber Co., Inc. The booklet contains diagrams of typical applications and the literature is arranged to be helpful to designers and users of "O" ring seals. Many line illustrations show the rings in various installations. The booklet is a condensed version of the "O" ring story and is intended to show users the possibilities of the "O" ring.

Circle 203 on Reader Service Card

HEAT EXCHANGER . . . Bulletin No. 120 prepared by Niagara Blower Co., describes the operation of the heat exchanger used in cooling or controlling of temperatures of industrial liquids. It shows the operation of this equipment by means of diagrams and examples of application by installation photos. Included is a large cut-away view showing the construction and how the unit operates.

Circle 204 on Reader Service Card

SOLENOID VALVES . . . Pilot pressure equal to operating line pressure is employed to shift the valve spool, thus permitting use of a small, continuous duty solenoid directional valve and eliminating need for large expensive, directly connected solenoid actuators. The valve may be used as a three-way, two three-way, two two-way combinations at pressures not exceeding 200 psi. Cross-section views aid in showing construction of the valve and its operation. Also line drawings show all dimensions necessary for installation purposes. Ask for SEC 11-A-24 released by Modernair Corp.

Circle 205 on Reader Service Card

GEARED MOTORS . . . Catalog CC-14A is a new 14 page technical brochure, including dimensions, operating characteristics, photographs and diagrams prepared by Belgian Electric Sales Corp. A geared motor is a unit consisting of an electric motor connected with a speed reducer in

Continued on Page 38

Circle 36 on Reader Service Card →

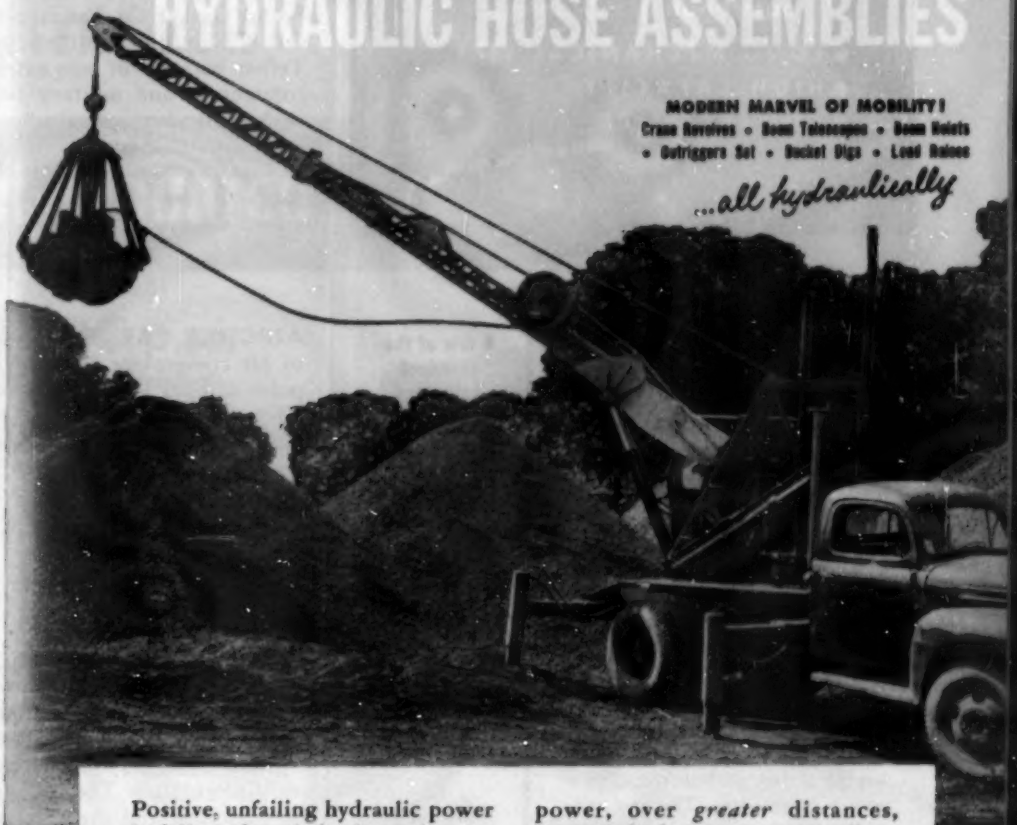
SAFEGUARDING INDUSTRY'S *Lifelines of Mobile Power*

6 HYDRAULIC MOVEMENTS OF BUCYRUS-ERIE HYDROCRANE RECEIVE POSITIVE POWER THROUGH . . .

Eastman

first in the field

HYDRAULIC HOSE ASSEMBLIES


MODERN MARVEL OF MOBILITY!
Crane Revolves • Boom Telescopes • Boom Hoists
• Outriggers Set • Bucket Digs • Load Raises
...all hydraulically

Specify ✓ *Eastman first in the field* **HYDRAULIC HOSE ASSEMBLIES**

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Solid Male

Swivel Male

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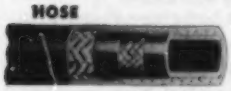
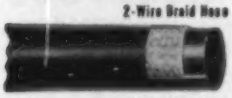
HOSE


1-Wire Braid Hose

2-Wire Braid Hose


1-Fabric Braid Hose

2-Fabric Braid Hose

Spiral Wire Hose

Positive, unfailing hydraulic power is delivered to six basic motions on many Bucyrus-Erie H-3 Hydrocranes through dependable Eastman Hydraulic Hose Assemblies.

Eastman, *first in the field* of Hydraulic Hose Assemblies, pioneered in many original applications of mobile hydraulic power. As early as 1926, J. Peter Eastman experimented with wire braided hose.

Continued Eastman developments have made it possible to apply *more* power, over *greater* distances, through *higher* pressures—until today, 6,500 psi are withstood by the Eastman 3-wire braid hose assemblies used on many Bucyrus-Erie H-3 Hydrocranes.

Take advantage of our 25 years of experience in the application of mobile hydraulic power to manufacturer's original equipment. Engineering consultation on special problems is our specialty . . . complete service yours to command.

Write for free catalog 100 on Eastman hose couplings and fittings.

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MANUFACTURING COMPANY

Since 1914

Dept. AH-6, Manitowoc, Wisconsin

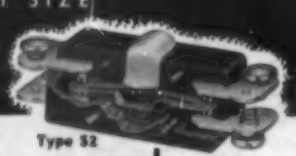
ELECTRO SNAP

snap-action

BASIC SWITCH

offers you three outstanding advantages

- LONG MECHANICAL LIFE
- HIGH CAPACITY
- COMPACT SIZE



Type 52
Cut-away model illustrated.

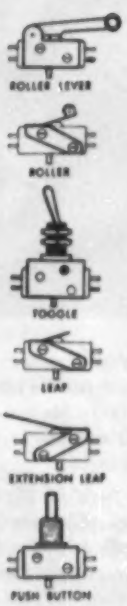
The advantages are *ALL YOURS* . . . with this improved switching component. Over 10,000,000 mechanical operations *plus* precise repeatability, give you unlimited application possibilities. The durable plastic case measures only 1¼" long, ½" wide and ½" high, permitting more compact designs and mounting arrangements.

The positive snap-action of the silver contacts minimizes arcing, assures precision control and renders long electrical operation. The patented, self-aligning springs provide the much desired contact wiping action, seldom found in a switch of this size. The new self-lubricating nylon button provides extremely long life and will directly accept actuator cams up to 45 degrees rise. Rated at 10 amps 125/250 V. ac or 30 V. dc.

To enjoy the *very best* in switching . . . *buy Electro-Snap* for your next application.

Write in today, for detailed specification sheet STF-6.

A few of the standard actuators available.



ELECTRO-SNAP SWITCH AND MFG. CO.
4224 West Lake Street, Chicago 24, Illinois

USEFUL LITERATURE

Continued

order to provide a slow speed drive. The reduced speed is obtained by one or more gear reduction sets. Gear reductions from 1 to and including 6 are available. Many items of interest are discussed including mounting, position of motor shaft, lubrication, classification, selection, weights, prices and typical applications.

Circle 206 on Reader Service Card

"O" RINGS AND BACK-UP RINGS . . . United States Gasket Co. has issued a new catalog No. OB-1152 on their synthetic rubber "O" rings and Teflon back-up or non-extrusion rings for both commercial and military requirements. Gaskets, packings and universal tube fittings are included. Back-up rings in three types, spiral, solid rings and split rings are illustrated and described. Four pages of easy reference selection tables and engineering data are also included.

Circle 207 on Reader Service Card

AIRCHEK VALVE . . . A discharge check valve in air compressor lines which works well as a pulse-damper is described in bulletin No. 509-C, offered by Pennsylvania Pump & Compressor Company. Complete information is given on operation, features, construction. One of the outstanding features is its noiseless operation. A cross-section view illustrates clearly how the valve is constructed.

Circle 208 on Reader Service Card

PRESSURE MEASURING DEVICES . . . for aerodynamics, hydrodynamics, engine research, pressure control and ballistics. The devices feature miniature size and flush mounting. A 4 page bulletin by Dynamic Instrument Co., Inc., carries this information. The new pressure pickup design is explained and the specifications are tabulated for each diaphragm diameter. Performance as to sensitivity, linearity, hysteresis, temperature range and drift, and acceleration are given.

Circle 209 on Reader Service Card

RESET SWITCHES . . . either manual or mechanical reset are described in data sheet 69, offered by Micro, a Division of Minneapolis-Honeywell Regulator Co. They are designed for industrial applications, requiring sustained contact after plunger force has been relieved but with provision for resetting the switch for succeeding operations. The enclosed switch assemblies have a plunger that operates through the

Continued on page 40

LOOK

RIVETT OFFERS *NEW*

Series 6600
Solenoid Pilot Operated.
Furnished in 1/2", 3/4", 1" 1-1/4" and 1-1/2" I.P.S.

gasket-mounted hydraulic valves

4-way 3000 p.s.i.

Designed and Built to J.I.C. Standards

Advanced features offer you broader opportunity for control

Series 6500
Direct Solenoid Operated.
Furnished in 1/4" I.P.S.

1. Greater flow capacity. (Ex: 6600 series ¾" size rated at 28 G.P.M. at 15 ft. per sec.)
2. Less pressure drop.
3. More compact in size.
4. Seven spool designs for 3 and 4-way control.
5. Dust sealed and moisture resistant. Roomy wiring box.
6. Continuous duty, shock mounted solenoids. 3.6 amps inrush and .45 amps holding at 115 V.
7. Shock resistant spool. Scalloped design and metering grooves eliminate impact.
8. All surfaces precision ground.
9. May be mounted in any position.
10. High tensile, nickel alloy body.

RIVETT LATHE & GRINDER, Inc.
Brighton 35, Boston, Mass.

COMPARE and PROVE!
Get new Catalog —

shows *why* new Rivett gasket-mounted solenoid pilot valves are best; illustrates flow operations for all piston designs. This book is a must on every board—easy to understand, it will simplify your valving problems. Write today!

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Brighton 35, Boston, Mass.
Please send free Catalog 260.

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RIVETT **furnishes a complete power package**

VALVES • CYLINDERS • POWER UNITS

Air and Hydraulic • All sizes and types

STEEL HYDRAULIC COUPLINGS

"THE MOST COMPLETE FITTING LINE"

JIC FLARED TUBE
DRYSEAL PIPE FITTINGS
RESTRICTORS
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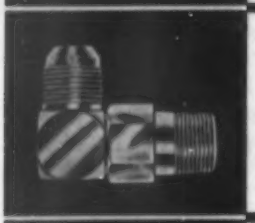
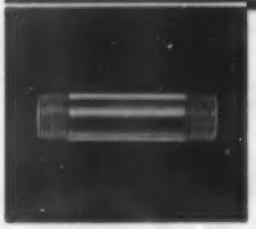
new products:

NEEDLE VALVES
- 5000 PSI
- Compact, bar stock body
- Use for shut-off or metering
- Tube or pipe outlets
- Line or angle

BALL CHECK VALVES
- Compact, bar stock body
- Tube or pipe outlets
- Fixed or adjustable spring loading



SWIVEL ELBOWS
- 1200 PSI
- Tube or pipe outlets
- Rotates 360°



PIPE NIPPLES
- Clean bore, seamless steel tubing
- Dryseal NPTF threads
- Cadmium plated

Representatives in principal cities
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Circle 70 on Reader Service Card

USEFUL LITERATURE

Continued

top and a reset plunger that operates through the bottom of the enclosure. Complete information is given for all types available and all necessary dimensions. A few of the types covered are: sealed plunger actuator, roller arm sealed plunger actuator, and over travel plunger actuator.

Circle 210 on Reader Service Card

OVERSIZE CAPSCREWS . . . for diameters over 3 in and lengths over 12 in up to 36 in are described in a 4 page illustrated folder, Form 2002, prepared by Standard Pressed Steel Co. The capscrews are specially engineered for large presses and the latest machine tools. They have a socket head construction and can be countersunk and used in flush designs.

Circle 211 on Reader Service Card

FLARED TUBE FITTINGS . . . for tubing of all standard wall thicknesses are covered in Bulletin J-100-B released by The Aircraft Fitting Company. Some of the features of the fittings are outlined, such as the adequate length and design of the nut which insures tube support, dampening and controlling vibration. The fittings have 37 degree flare angle and long threads; they are easy to connect and disconnect and they conform to J.I.C. hydraulic standards. All pertinent data is given as to sizes, part numbers and prices. Each type of fitting is illustrated.

Circle 212 on Reader Service Card

ELECTRICALLY CONTROLLED AIR FEED . . . for drilling and tapping machines is discussed in a 4 page folder prepared by Beckett-Harcum Co., Inc. How controlled air powered thrust provides correct drilling and tapping action is described. The bulletin is complete with engineering data and specifications. Line drawings and installation dimensions add to the value of the bulletin.

Circle 213 on Reader Service Card

BALL BEARING PILLOW BLOCKS . . . for applications where speeds are relatively low and loads are light are presented in folder No. 2517, offered by Link-Belt Company A deep-groove single row ball bearing, self-aligning in all directions are features of the unit. Free rolling action and full load capacity are maintained even with minor shaft deflection or normal misalignment.

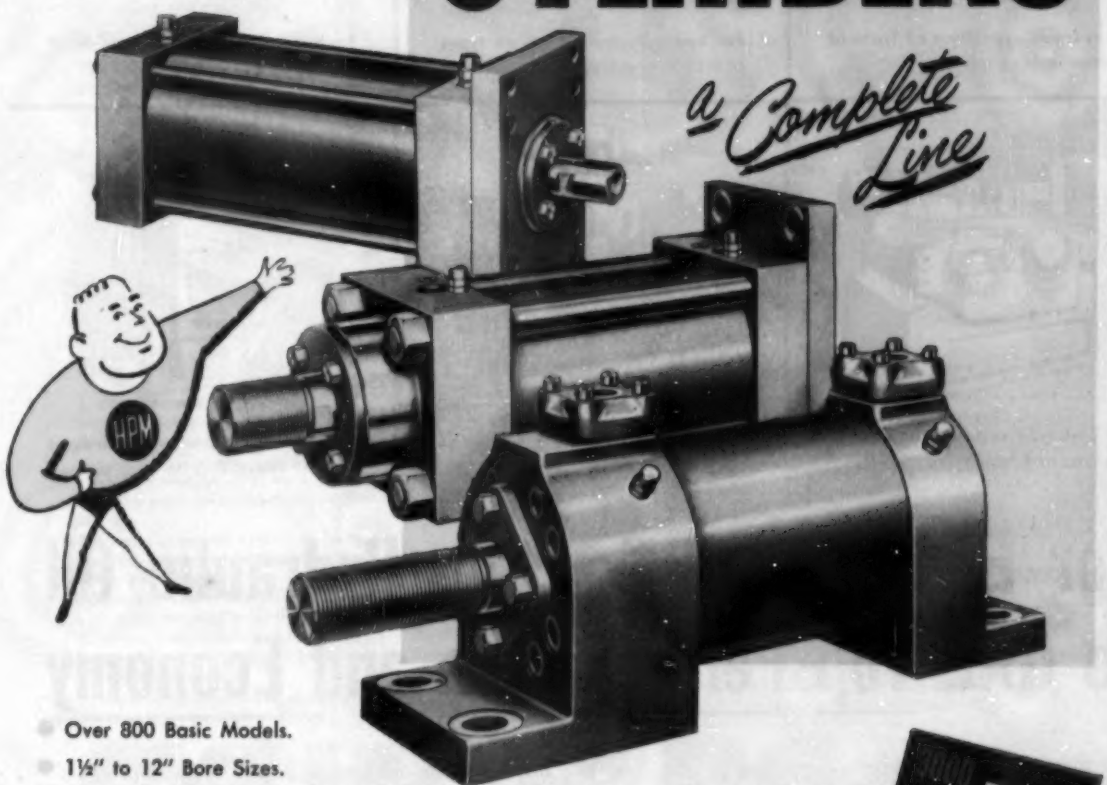
Circle 214 on Reader Service Card

For more reviews of Free Literature turn to page 118

HPM HYDRAULIC POWER DIVISION

CYLINDERS

a Complete Line



- Over 800 Basic Models.
- 1½" to 12" Bore Sizes.
- 150 P.S.I. Air, or 300-2000-3000 P.S.I. Oil Hydraulic Service.
- Large Choice of Mountings, Standard and Combinations.
- Male or Female, standard or 2:1, single or double end piston rods.
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- Single acting, collapsible or telescopic, large bore and other special cylinders to meet unusual requirements.

Ask for new H-P-M Catalogs covering cylinders best suited to your requirements.

Cat. #701—150 P.S.I. Air, 300 P.S.I. Oil Cylinders
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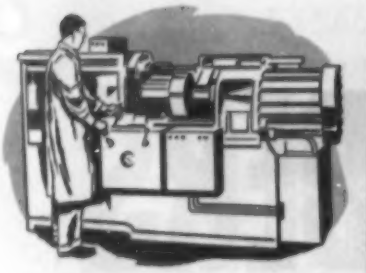
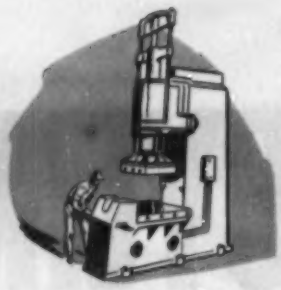
A Factor in the Field of Hydraulics Since 1877!

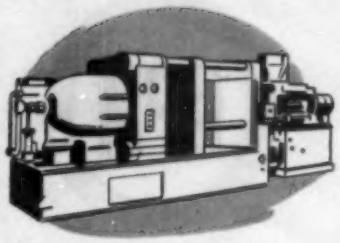
ONE SOURCE FOR ALL COMPONENTS!



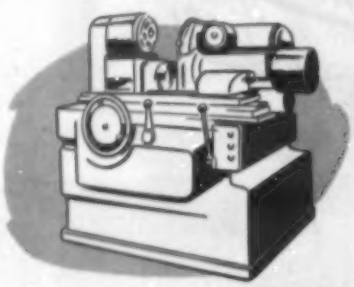
For hydraulic systems on all types of injection molding machinery.



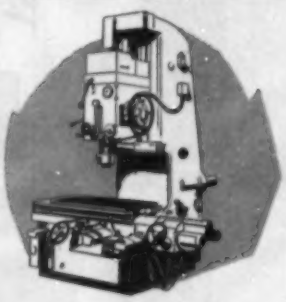
For hydraulic systems on all types of presses and forging hammers.



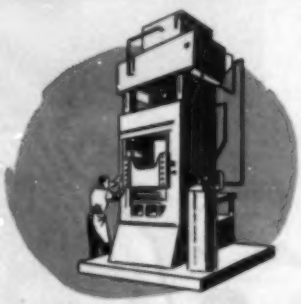
For hydraulic systems on all types of plastics molding equipment.



For hydraulic systems on grinding machines and other production tools.



For hydraulic systems on jig borers and other metalworking machinery.



For hydraulic systems on standard and special heavy-duty forming presses.

For Every System, a Sun Hydraulic Oil to Give Top Performance and Economy

Sun makes a variety of hydraulic oils, because *no single oil will meet all combinations of conditions economically.* Among the many hydraulic oils made by Sun the following cost-cutting products are typical.

SUNTAC OILS. Designed to cut leakage. They reduce it an average of 35%—and results are immediate. But they wouldn't be economical in a tight system.

SUNVIS H.D. 700 OILS. Clean dirty systems in 50 hours or less without loss of production. But they wouldn't be economical in systems that leak badly.

NEW SOLNUS OILS. Resist oxidation, prevent rusting and corrosion. They are low in cost and have long service life. But they wouldn't be economical in systems where excessive contamination is a problem.

Among the many different hydraulic oils made by Sun, there's one that's best for your system—a hydraulic oil that will give top performance at lowest possible cost. Consult your local Sun office or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. AH-6.

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Refiners of the famous Blue Sunoco Gasoline and Dynalube Motor Oils

FOR YOUR

SERIES "N" HYDRAULIC CYLINDERS

- Long recognized as the finest hydraulic cylinder made.
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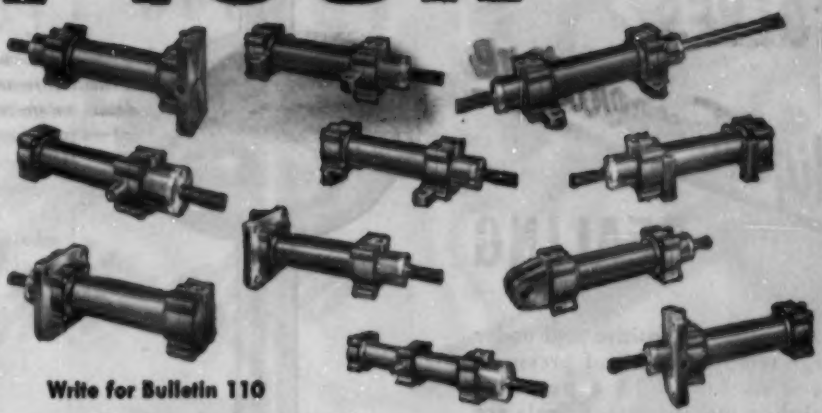
- 12 bore sizes, 1" to 8"
- 11 mounting styles; many combination mountings available

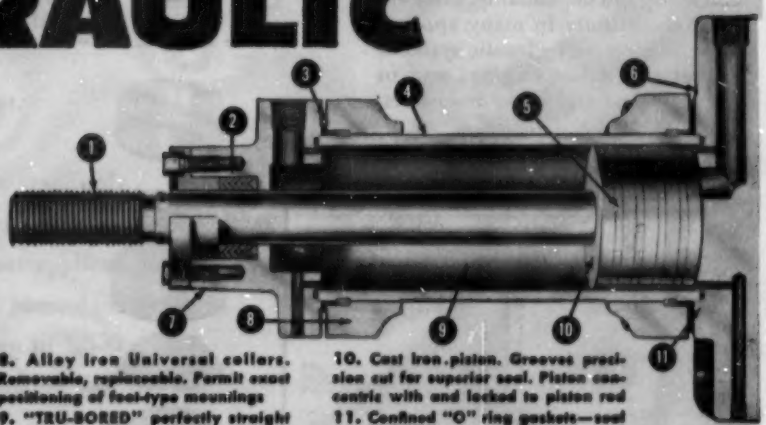


Write for Bulletin 110

HYDRAULIC

ADVANTAGES

1. Ground steel piston rod. Concentric with and locked to piston
2. Pre-adjusted chevron packings in non-adjustable gland. This eliminates over-tightening, binding, etc.
3. Alloy steel bolts—heat-treated for strength
4. Seamless steel cylinder. Extra strength. Piloted to end caps to assure concentric assembly
5. Positive seal piston rings. Lapped both sides for minimum oil slip
6. Alloy iron Universal end caps. Rugged. Port completely rotatable—air vents four sides
7. Cushioned caps when specified. Eliminate shock at end of stroke



8. Alloy iron Universal collars. Removable, replaceable. Permit exact positioning of foot-type mountings
9. "TRU-BORED" perfectly straight and round, then honed satin smooth
10. Cast iron piston. Grooves precision cut for superior seal. Piston concentric with and locked to piston rod
11. Confined "O" ring gaskets—seal positively, cannot extrude

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HANNIFIN "CUSTOM" HYDRAULIC CYLINDERS

- Built in quantity for use on customers' products
- Specially designed for each application
- Often the most economical way to buy hydraulic cylinders

Bring us your cylinder problems.

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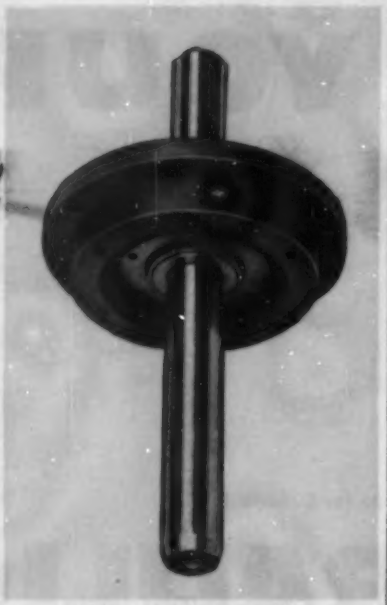
Air and Hydraulic Cylinders • Hydraulic Power Units • Pneumatic and Hydraulic Presses • Air Control Valves

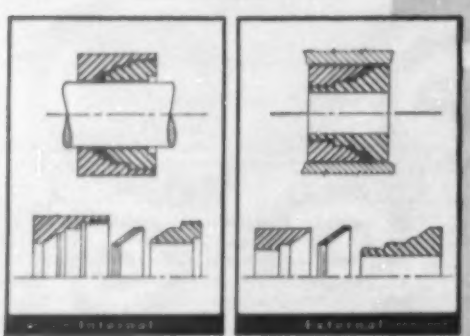
SOLVES *High Temperature* SEALING

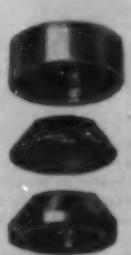
• Assurance of positive seal under high temperatures and pressures need no longer be a problem. Sylphon metallic Reed Seals are engineered to meet those conditions efficiently and dependably. They are used successfully in many applications in aircraft, hydraulic systems, Diesel and other engines and in the chemical and other industries.



Sylphon Reed Seal, installed.

Complete all-metal seal.





Exploded view showing parts.

CHECK THESE ADVANTAGES

Wide range of materials. Metallic seals can be made of Inconel "X", Truflex 720, Duranickel, bronze and stainless steel. For lower temperatures, plastic seals used are nylon and Teflon.

Broad temperature range. Typical examples: Inconel "X", -100° F. to 1200° F.; Duranickel, -100° F. to 900° F.; stainless steel, -100°F. to 650°F.

Pressures to 3,000 psi.

Excellent corrosive resistance to many chemicals, aromatic fuels, hydraulic oils, etc.

Seal external or internal cylindrical surfaces; also flat seals can seal flanged or parallel surfaces.

No deterioration in stock.

Write today for information. Ask for Bulletin LU-827

Robertshaw-Fulton CONTROLS COMPANY

FULTON SYLPHON DIVISION • KNOXVILLE 1, TENN.

Letters to the Editor

Continued from Page 34

title, "Sequential Circuit Operates Robot Man". A tear sheet has been forwarded to you. For additional details on the construction of this interesting piece of equipment, we suggest that Mr. R. C. Taisey, sales engineer, Rivett Lathe & Grinder, Inc., Brighton 35, Boston, Mass., who designed and built the robot, would be glad to be of asistance. Good luck with your robot at the Sydney show!

Pneumatics Reprint

The installment in this issue, "Diaphragm Valves" is the last scheduled article in the series "Beginners' Course in Basic Pneumatics". The entire series will be reprinted in booklet form. As soon as the reprint is ready, announcement will be made in APPLIED HYDRAULICS.

Tubing Information

We would appreciate information leading to the location of a material specification handbook covering all welded and seamless steel tubing. In the past we have not been able to get a material breakdown on several types of tubing that we have in use. Currently we concerned with a MS-550-C. We k..ow this to be a seamless tube but can find absolutely no catalogue referring to this particular item.

DAVID P. SMITH
Saginaw Steering Gear Division
General Motors Corporation
Saginaw, Michigan

The Stainless Steel Tube Institute, Gulf Building, Pittsburgh, Pennsylvania, publishes the manual "Seamless Steel Tube Data," which we believe you will find useful. The Tubing Specialties Division of National Tube Company, Pittsburgh, also publiishes a manual "Seamless Steel Tubes for Mechanical and Pressure Purposes", which gives specifications.

In addition, SAE Handbook lists specifications for steel tubing, both welded and copper brazed, which we believe you would also find useful.

HEAVY DUTY

Hydraulic Cylinders

- **All steel construction—no tie rods, no castings.**
- **Hard chromed and ground piston rod to resist abrasion and prolong seal life.**
- **Self adjusting seals.**
- **Five standard mountings.**
- **Ample rod guide.**
- **Rod wiper seals fitted as standard.**
- **Cushioning at either end or both ends of stroke.**
- **Stroke length to suit your application.**
- **Standard range 2" to 6" bore, double acting.**
- **For working pressures up to 1,500 p.s.i.**
- **Double ended rods available for all standard cylinders.**
- **Special mountings, larger bores and cylinders for higher pressures by arrangement.**

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PUMP/MOTOR UNITS, VALVES, POWER PACKS, TRANSMISSIONS & REMOTE CONTROL SYSTEMS

The recognised Authority on Hydraulic Power Transmission

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Telephone : Meriden 225/6 Telegrams : Keelavite, Coventry

FOR FULLER INFORMATION PIN THIS CORNER TO YOUR LETTERHEADING and post it to KEELAVITE ROTARY PUMPS AND MOTORS LIMITED ALLESLEY COVENTRY England

AH/3.1

SKINNER V5-3 THREE-WAY SOLENOID VALVES

NOW with "QUICK EXHAUST"

Operates twice as fast!

COMPACT
LEAKPROOF
TROUBLE-FREE

Skinner engineers have now added to Skinner V5-3 Series Valves a new feature that assures faster operation of machinery than is possible with Standard V5-3 valves. It's "Quick Exhaust" — achieved through utilization of pressure differentials and a quick exhaust orifice ⅛" in diameter. "Quick Exhaust" speeds up the return stroke of small air and hydraulic cylinders . . . boosts operating speeds.

Skinner V5-3 Quick Exhaust valves are three-way, normally closed. Their soft, synthetic plunger inserts and positive, spring-loaded operation assure leakproof performance — *through millions of cycles.* Bodies and internal parts are made of stainless steel. Moisture-resistant, varnish-impregnated coils are another quality feature.

Valves of this series are compact — precision-built yet rugged — designed and manufactured to give years of dependable service.

SPECIFICATIONS

Pressure Ratings.....50, 75, 100, 150 P.S.I.
Orifice diameters.....⅛", 3/32", 1/16", 1/64"
Secondary exhaust diameter.....3/32"
Pipe Size.....⅛" or ¼" NPT
Voltage.....All common AC, DC Voltages
Power Consumption.....9 Watts Maximum

Write for Bulletin 530

TYPICAL SKINNER VALVES

M3 – three-way Pilot Operated 5-150 p.s.i.
V10 Hydraulic 0-1000 p.s.i.
X5 Explosion Proof 0-1000 p.s.i.
V2 two-way Stainless Steel 0-200 p.s.i.
V5-2 two- and three-way Industrial 0-1000 p.s.i.
V9 Four-Way 50-150 p.s.i.

Write for information about our complete line.

SKINNER SOLENOID VALVES

THE SKINNER CHUCK COMPANY
105 EDGEWOOD AVENUE, NEW BRITAIN, CONNECTICUT

Free Literature Offered in this Month's Ads

For more information circle numbers on the reader service card bound in this issue on page 136.

PLASTIC CLOSURES for protecting threads and ports are described with full details in bulletins P-5203 and P-5312. Applications and features are available from The S.S. White Plastics Division, Dental Mfg. Co.

Circle 127 on Reader Service Card

Graton & Knight International catalog and manual 201-A contains 60 pages of up-to-date data including latest JIC and officially recommended sizes for ALL TYPES OF PACKINGS.

Circle 49 on Reader Service Card

Portable hydraulic POWER PACKAGE, applicable wherever low volume output at high pressures is the requirement, Bulletin No. 500, describes the unit completely which is for water or oil service. Write to Sprague Engineering and Sales Corp.

Circle 129 on Reader Service Card

"Engineering with Sirvene" is a book which tells all about Chicago Rawhide service and their SYNTHETIC RUBBER PARTS. A copy is available by writing to the company.

Circle 28 on Reader Service Card

A complete stock list can be obtained of all AIR CYLINDERS available from Miller Fluid Power Co. Also bulletin A-105 and H-104 may be secured from the company, which presents the features, specifications etc.

Circle 78 on Reader Service Card

A detailed folder gives information on a new BALL VALVE for liquids, gas or steam. Write to The Foxboro Co.

Circle 44 on Reader Service Card

Continued on page 50

ANCHOR

DUCTILE-SLEEVE, TWO-WIRE BRAID HOSE ASSEMBLIES

for extra safety in high-pressure usage

Factory assembled to your specifications — you get just what you want — plus an extra margin of safety and dependability.

Exclusive, ductile-sleeve, swaged-on grip makes coupling virtually part of hose reinforcing wire — prevents blow-offs.

No leaks — positive seal eliminates leakage even under extreme pressures.

Cuts assembly costs — neat, compact design makes installation fast and easy — gives you a better-looking job.

Get all the details. Attach coupon to your letterhead and mail today.

NEW!
REVOLUTIONARY
ANCHOR FLANCO
SPLIT-FLANGE CLAMP
Positive leakproof connection without threaded joints. Bolt centers are located to distribute the forces evenly and prevent tilting of the clamp halves. Easy to assemble with small automotive-type wrench.

D-16

ANCHOR COUPLING CO. INC.

Main Office and Factory: LIBERTYVILLE, ILLINOIS

FACTORY BRANCHES: DETROIT, MICHIGAN • DALLAS, TEXAS

Anchor Coupling Co. Inc.
Dept. AH64, Libertyville, Illinois

I'd like to know more about

- ☐ Anchor Ductile-Sleeve Hose Assemblies
- ☐ New Anchor Flanco Split-flange clamp-type coupling

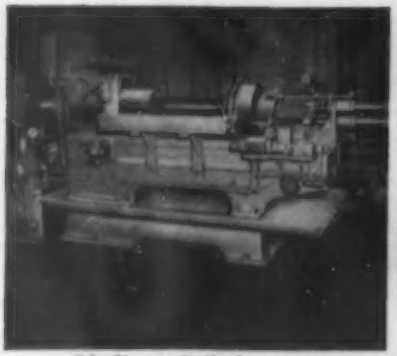
Send me more information.

Name _____ Title _____

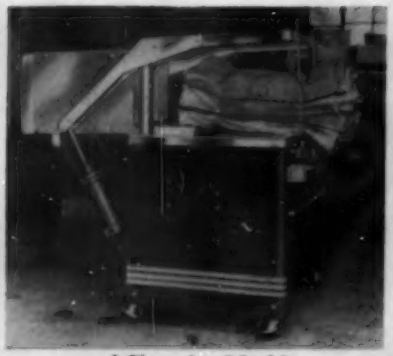
Company Name _____

Company Address _____

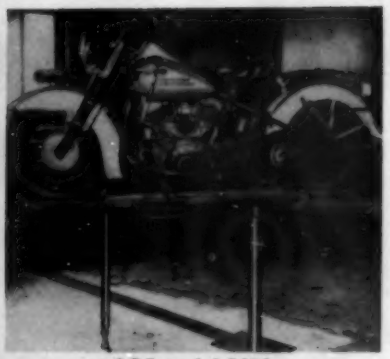
City _____ State _____



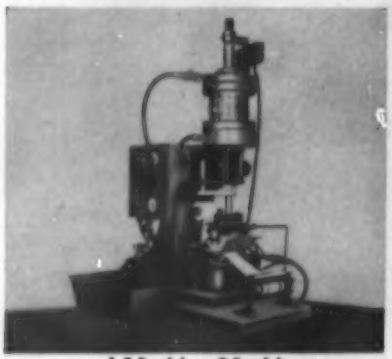
Lindberg Cylinders are used on Machine Tools



. . . and Clamping Machines



. . . and Material Lifting Equipment



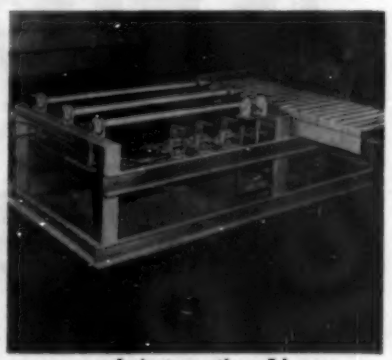
. . . and Marking Machines

. . . and Steel Mill Material Handling Equipment

. . . and Heat Treating Furnaces

. . . and Hydraulic Presses

. . . and Cutting Machines



. . . and Automation Lines

Original Equipment Manufacturers use *LINDBERG* Cylinders

(Lindberg offers a complete line of Air and Hydraulic Cylinders. Ask for Bulletin No. 800)

LINDBERG AIR . . HYDRAULIC CYLINDERS

Lindberg Air and Hydraulic Division, Lindberg Engineering Company, 225 North Laflin Street, Chicago 7, Illinois

Circle 74 on Reader Service Card

Reduce Fire Hazards

use HOUGHTO-SAFE

the hydraulic fluid that won't burn or explode!

HOUGHTO-SAFE gives you this 4-WAY SAFETY!

SAFETY FROM FIRE

Houghto-Safe won't burn or flash—even when sprayed into open flames! This new hydraulic fluid . . . rated "acceptable from the fire hazard standpoint" by the Factory Mutual Laboratories . . . now proves that fire-resistant qualities *can be obtained without loss in operating efficiency!*

SAFETY FROM WEAR

Houghto-Safe is reinforced for high film strength —longer life for moving metal parts.

SAFETY FROM TOXICITY

Houghto-Safe is non-toxic—safe to handle—has no unpleasant odor!

SAFETY FROM PACKING ATTACK

Houghto-Safe has no ill effect on synthetic rubber packings—won't impair efficiency! Ask the Houghton Man for our new bulletin, containing research data, case histories and pictured proof of Houghto-Safe's efficiency. Or write to E. F. Houghton & Co., 303 W. Lehigh Avenue, Philadelphia 33, Pa., for answers to any questions you may have about this new, safe, hydraulic fluid.

HOUGHTO-SAFE Non-Flammable Hydraulic Fluid

. . . a product of

E. F. HOUGHTON & CO.

PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

Ready to give you on-the-job service . . .

your leather packings are only as good as the leather they're made from

That's why Rhoads Packings are made from premium Tannate leather. Tannate is a special tanned leather, developed for industrial applications exclusively. It's a flexible leather, which means it can be formed with a minimum of strain, and yet retain a higher proportion of the leather's natural strength. Because of this extra strength Tannate will withstand the highest pressures to which any packing can be subjected with a minimum of cold flow or extrusion. Tannate leather is a non-abrasive material, therefore these packings will not score or abrade cylinder walls or pistons. Impregnated to meet your requirements, Tannate leather packings become adaptable to a wide range of operating conditions . . . they can be made hard as rock or soft and flexible.

Tannate packings are precision molded and finished to provide an effective seal against glycerin, alcohol, mineral, fish and animal oils . . . water, vegetable or any other non-caustic, non-acid fluid. For more specific information write J. E. Rhoads and Sons, 35 North 6th Street, Phila. 6, Pa.

RHOADS

INDUSTRIAL LEATHERS

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Free Literature Offered in this Month's Ads

Continued

Cuno Engineering Corp. are offering a bulletin on the low pressure drop operation of their STRAINERS, which enables the full-flow service on gravity, low pressure or high pressure suction lines.

Circle 32 on Reader Service Card

A dual-vane, 2000 psi HYDRAULIC PUMP is described in bulletin No. DP-302. All facts in regard to this pump are included. Available from Dudco Division, The New York Air Brake Co.

Circle 35 on Reader Service Card

With pressures up to 500 psi, PUMPS which will meet practically any mounting requirement, are described in a 70 page catalog 35P, offered by Brown & Sharpe Mfg. Co.

Circle 22 on Reader Service Card

How to simplify your VALVING PROBLEMS is discussed in a new catalog released by Rivett Lathe & Grinder, Inc. Features of the new gasket-mounted hydraulic valves are included.

Circle 101 on Reader Service Card

If you would like to know more about ductile sleeve HOSE ASSEMBLIES and split-flange clamp-type COUPLINGS, write to Anchor Coupling Co. Inc., for literature.

Circle 13 on Reader Service Card

"O" RING data for engineers, including design and compound information, gland grease, and back-up ring requirements is available from National Motor Bearing Co. Inc.

Circle 83 on Reader Service Card

Lever operated HYDRAULIC VALVES for line pressures up to 5000 psi are described in data sheets prepared by C. B. Hunt & Son, Inc.

Circle 62 on Reader Service Card

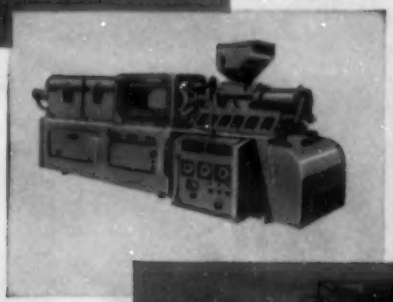
Continued on page 53

'VSG'

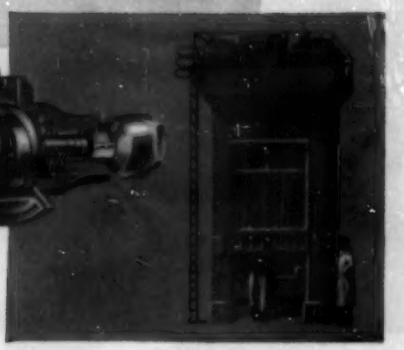
Reg'd Trade Mark

Infinitely VARIABLE DELIVERY PUMPS

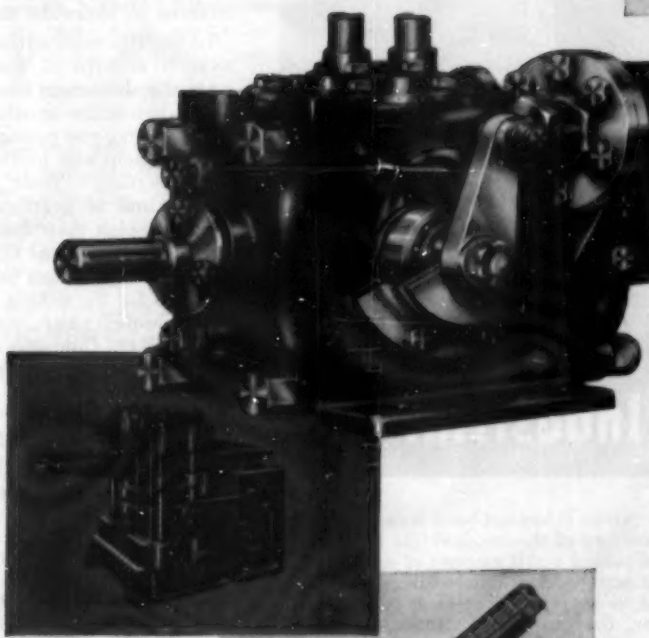
Mobile Manipulator



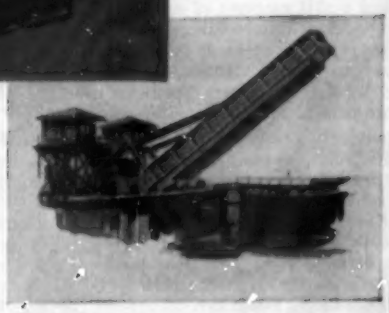
Injection Moulding Machine



Hydraulic Press



Matrix Press



Rolling Lift Bridge

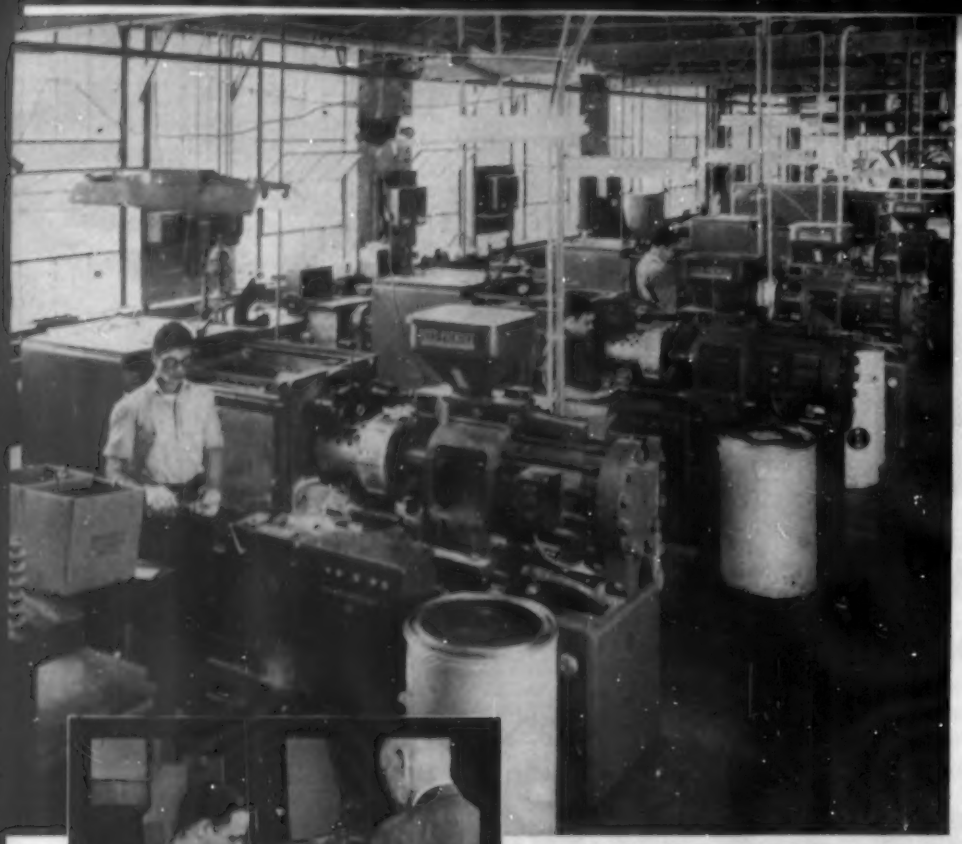
'VSG' Pumps are axial piston pumps of high volumetric efficiency, giving infinitely variable delivery from zero to maximum pump capacity. They are made in seven sizes, delivering from 5 to 360 gallons/min. in three pressure ranges, 1000, 2000, 3000 p.s.i.

With the auto pump, as illustrated, delivery is automatically regulated by the pressure in the hydraulic system. The manually controlled variable delivery pump gives constant delivery for any given setting irrespective of pressure variations.

Full details on request from

VICKERS-ARMSTRONGS LTD

VICKERS HOUSE · BROADWAY · LONDON · ENGLAND · *Cables:* VICASTRONG LONDON



Despite cleanliness and efficiency of a midwest firm's Plastic Division, shown above, there was "dirty work" afoot in the hydraulic systems of the injection molding machines. Division superintendent (left) and A. L. Seabaugh, of Standard Oil, came up with a solution.

Stops "dirty work" in hydraulic units

● A midwest company became increasingly aware that hydraulic oil performance in its fourteen injection molding machines was not all that it should be. Formation of oil deposits not only made frequent cleaning of filters necessary but posed a threat to efficient operation of the hydraulic units.

A Standard Oil lubrication specialist recommended STANOIL Industrial Oil, a top quality product of exceptionally high stability and containing necessary additives to prevent corrosion and oxidation troubles.

Throughout six years of continuous hard use, STANOIL has provided clean operation. It has not been necessary to replace any of the original fills of STANOIL, and only a small amount of make-up oil has been needed. Where filters previously had to be cleaned at least four times a year, they are now cleaned once each year. Hydraulic operation has been efficient and reliable.

STANOIL
TRADE MARK
Industrial Oil

You can rely on STANOIL to give you the same clean, dependable service not only in hydraulic units but in a wide variety of equipment. You can get the help of the Standard Oil lubrication specialist serving your section of the Midwest by phoning your local Standard Oil office. Or, write: Standard Oil Company, 910 S. Michigan Ave., Chicago 80, Illinois.

What's YOUR problem?

A. L. Seabaugh, working out of Standard's Chicago office, is the lubrication specialist who helped this midwest firm gain both operating and maintenance benefits through use of STANOIL in hydraulic units.

Located throughout the Midwest is a corps of specially trained, experienced Standard Oil lubrication specialists, ready to give you prompt, on-the-spot help with lubrication in your plant. Their broad background of practical experience, plus their thorough training in Standard Oil Lubrication Engineering Schools, is yours for the asking. Simply phone your nearest Standard Oil Company office. The lubrication specialist will call without delay. He has a complete line of petroleum products to offer, including such outstanding lubricants as:

SUPERLA Greases — Available in a wide range of consistency grades and in both lime-soap and soda-soap types. SUPERLA Greases cover a wide range of operations. These efficient products are comparable in quality with the highest type of special greases.

STANOLITH Greases — Because these unique lithium soap products possess the heat resistant properties of soda-soap greases and the water resistant properties of lime-soap greases, they offer a solution to lubrication problems caused by the presence of both heat and water.

STANDARD OIL COMPANY

STANDARD (Indiana)

Free Literature Offered in this Month's Ads

Continued

Quick-connective FLUID LINE COUPLINGS are described in a catalog released by The Hansen Manufacturing Company. These couplings provide instant automatic flow or shut-off.

Circle 55 on Reader Service Card

Catalog and a complete set of ½ and ¼ scale templates showing all CYLINDERS and mounting brackets can be obtained from Ortman-Miller Machine Co.

Circle 87 on Reader Service Card

HOZE-LOK catalog No. 4400 and a reprint of SAE standards for hydraulic hose and fittings, described in bulletin 4405, are available from The Parker Appliance Company.

Circle 90 on Reader Service Card

Catalog and handy selector charts are available from Lovejoy Flexible Coupling Co., on FLEXIBLE COUPLINGS.

Circle 77 on Reader Service Card

Full information on Pesco HYDRAULIC PUMPS, power packages, hydraulic motors, electric motors, controls and valves can be obtained from the company.

Circle 92 on Reader Service Card

Solenoid pilot operated air CONTROL VALVES designed and built to J.I.C. standards is described in bulletin A-6, released by Valvair Corp.

Circle 120 on Reader Service Card

Fire resistant HYDRAULIC FLUID is described in a report "Pydraul F-9" which will be sent on request by Monsanto Chemical Co.

Circle 81 on Reader Service Card

For full information on GEAR MOTORS write to Howell Motors for bulletin GM-1. Complete data is given on available models, speeds and horsepower.

Circle 61 on Reader Service Card

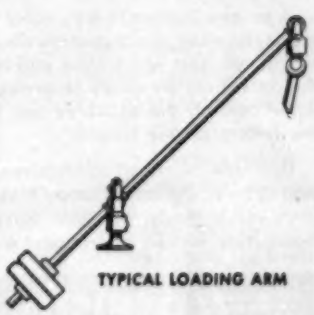
Continued on page 57

the **SWING** is to **EMSCO**

BALL BEARING SWIVEL FITTINGS

You'll find the *swing* is to Emsco when it comes to Ball Bearing Swivel Fittings. Compare Emsco with any other and you'll instantly detect its points of superiority, flexibility, safety, ease of takeup while in service, versatility of application and low cost. There's an Emsco for your every need. Type "LPR" for example, is popular for low pressure service. Smooth easy contour of bends reduces turbulence and increases flow. Choice of packing to suit your service.

Type **LPR**
For Standard Piping
Schedule 40



TYPICAL LOADING ARM

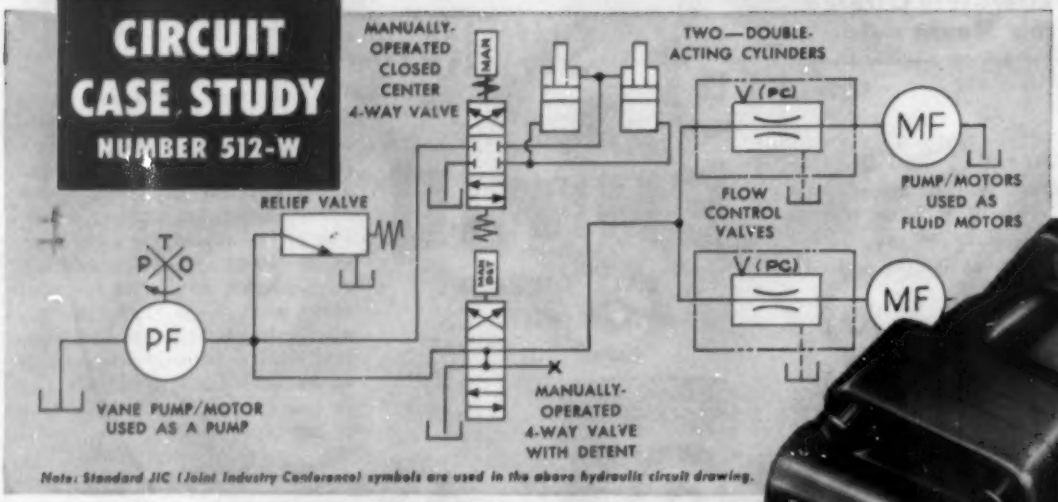
1. **FOR LOW PRESSURE SERVICE**
   Pressures to 1,000 P.S.I. and temperatures to 225° F.
   Sizes 1¼" to 4".
   For liquids, semi-solids, gases, steams, etc.
2. **FREE TURNING**
   Easy swiveling for full 360° in 1, 2 or 3 planes.
   Balls rotate on formed alloy steel races.
3. **FULL FLOW**
   Smooth bore, large easy bends.
4. **CHOICE OF PACKING**
   Molded synthetic rubber lip-type packing seal becomes tighter as pressure increases.

Send for complete catalog.

EMSCO

EMSCO MANUFACTURING COMPANY
BOX 2098, TERMINAL ANNEX
Houston, Texas **LOS ANGELES 54, CALIF.** Garland, Texas

CIRCUIT CASE STUDY
NUMBER 512-W



Note: Standard JIC (Joint Industry Conference) symbols are used in the above hydraulic circuit drawing.

Underwater weed-cutters powered by DENISON HydrOILic Pump/Motors

Unusual Circuit Also Features Denison Valves and Controls

Denison Controls and **Pump/Motors** power triple cutter bars in a fleet of boats specially developed to clear shallow inland waterways of weeds and other vegetation.

The circuit, shown above, affords positive control and power to three cutter bars, mounted on each side and across the bow of the boats. It replaces a complex, hazardous mechanical setup of open, rotating shafts, gears, pulleys, chains and belts.

The gasoline engine which powers the boat also drives a Denison **Pump/Motor** which acts as a pump.

Two additional **Pump/Motors**, one at the rear of each side-mounted cutter bar, drive the cutters through 5-to-1 reduction gearing and eccentrics. Drive rods delivering power to the cutters are interconnected by bell cranks.

A Denison 4-way valve, with detent, controls these two **Pump/Motors**. The detent permits the operator to leave the valve in either the "operating" or "off" position without holding the lever.

A Denison relief valve limits system pressure to the maximum pre-set rating. The mechanical linkage formerly used was subject to severe damage if the cutters struck an obstacle. Now, however, the cutters merely stall, and excess flow "spills" through the relief valve.

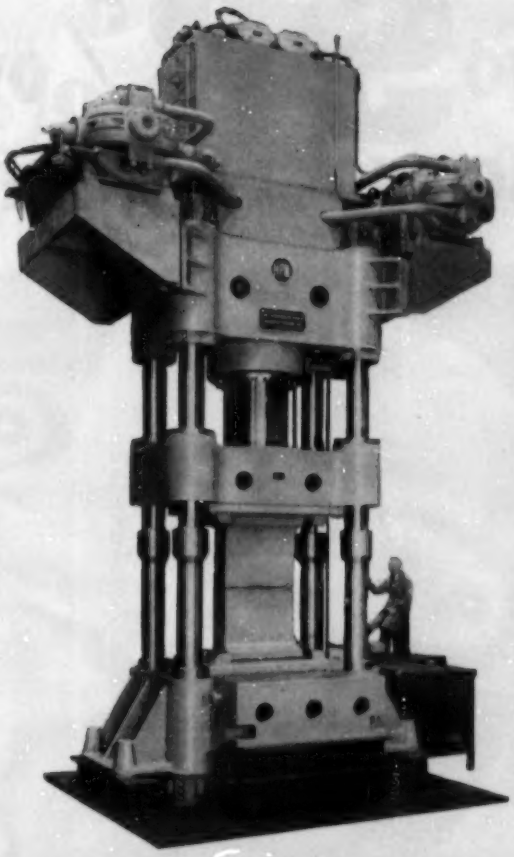
A second Denison 4-way valve with a closed-center spool controls double-acting cylinders which raise and lower the cutter bars. By simply centering this valve control, the operator can hold the cutters at any height.

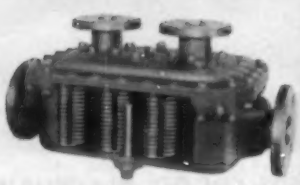
This type of circuit emphasizes advantages of Denison **Pump/Motors**. Each unit is ready for either pump or motor duty *without alterations!* A single "spare" can replace any of the three units, in any of the boats. **Pump/Motors** are single-stage, vane-type power packages with hydraulically balanced vanes, and simplified three-unit construction. They stand up under *long, hard, continuous duty* at pressures up to 2000 psi. Four sizes—each with a choice of cam rings for different needs—offer pumping capacities from 3 to 82 gpm . . . motor capacities from 8 to 98 hp (13 to 257 inch-pounds of torque per 100 psi.) All models can provide either clockwise or counterclockwise rotation.

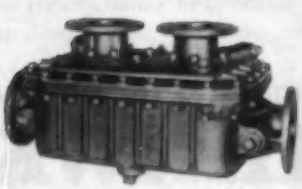
Denison offers an outstanding line of high pressure oil hydraulic pumps, motors and controls, for pressures to 5000 psi. Designed with skill and knowledge gained through twenty-five years of leadership in oil hydraulics, they have the compact ruggedness needed for exacting, heavy-duty demands. Wherever you need closely adjustable power and control with unlimited operating flexibility, specify HydrOILics. Write for more details.

The DENISON Engineering Company, 1166 Dublin Road, Columbus 16, Ohio

IT'S ALL A MATTER OF DEGREES!







Whether it's a huge hydraulic press or a small extrusion machine—you'll find Harrison heat exchangers on the job. For Harrison has been building dependable, high-efficiency oil coolers for all kinds of hydraulically operated equipment for a long, long time. Harrison heat exchangers *deliver the performance* and *have the built-in durability* that manufacturers demand. No matter what the cooling requirements are, Harrison can give you the *right* heat exchanger for your job.

Our research and testing facilities are the most modern and extensive in the business. If you have a cooling problem . . . look to Harrison for the answer!

HARRISON RADIATOR DIVISION, GENERAL MOTORS CORP., LOCKPORT, N. Y.

HARRISON

TEMPERATURES MADE TO ORDER

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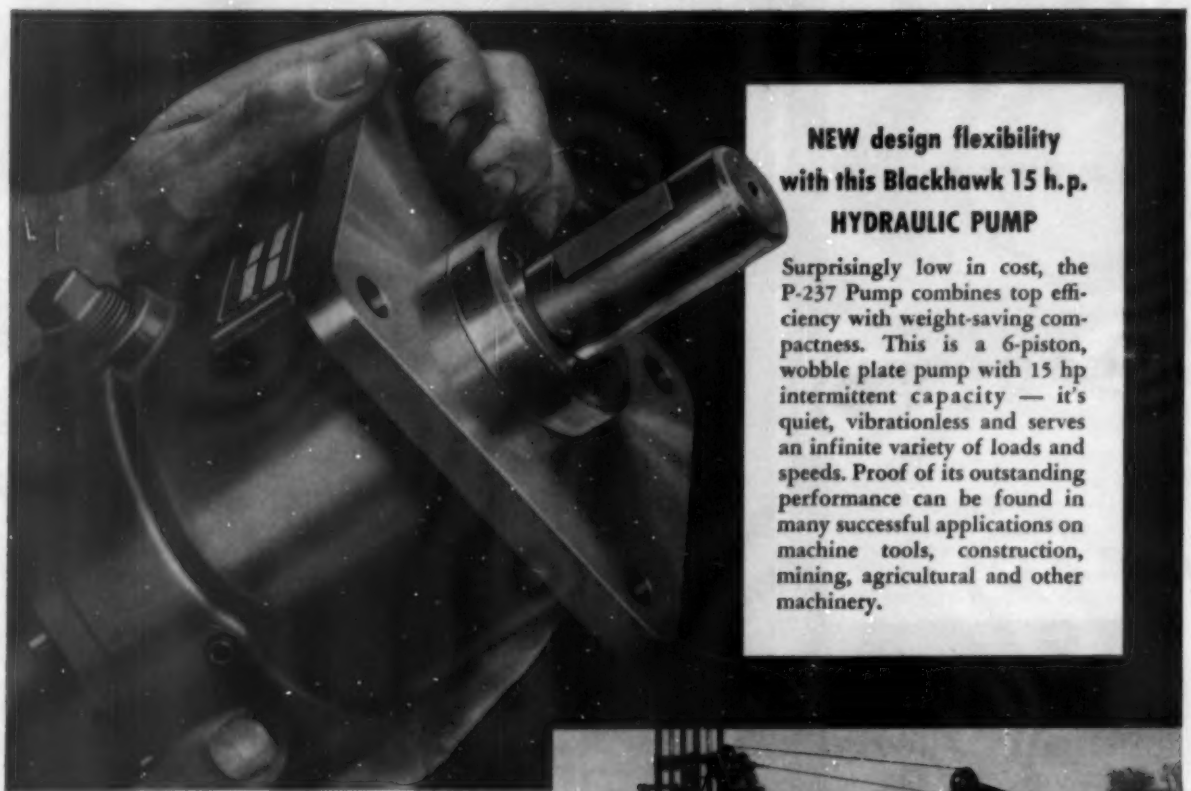

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Continued

Large, illustrated catalogs on FILTERING hydraulic oils may be obtained by asking Purolator Products, Inc. Information is available on industrial, aviation, automotive and fleet type filters.

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Bulletin A-1289, on AIR-COOLED PUMPS and A-1523 covering WATER-COOLED models, for air, vacuum and liquid service can be secured from Kraissl Co.

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Precision Rubber Products Corp. is offering a handbook which contains complete information on "O" RINGS.

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Several new catalogs on CYLINDERS are available from Hydraulic Power Division, The Hydraulic Press Mfg. Co. They cover 150 psi air, 300 psi oil cylinders, 2000 and 3000 psi oil cylinders.

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PRESSES and AIR CYLINDERS are products covered in a catalog released by Air-Mite.

Circle 5 on Reader Service Card

E. F. Houghton & Co. bulletin on HYDRAULIC FLUID, contains research data and case histories on the fluid that will not burn or explode.

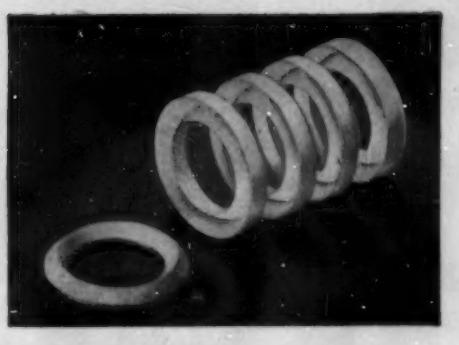
Circle 60 on Reader Service Card

How to prevent sludging of pumps and valves with OIL FILTERS and OIL RECLAIMERS is described in a bulletin prepared by The Hilliard Corp.

Circle 57 on Reader Service Card

High pressure HYDRAULIC CYLINDERS are discussed in catalog 104, prepared by The S-P Mfg. Corp.

Circle 104 on Reader Service Card



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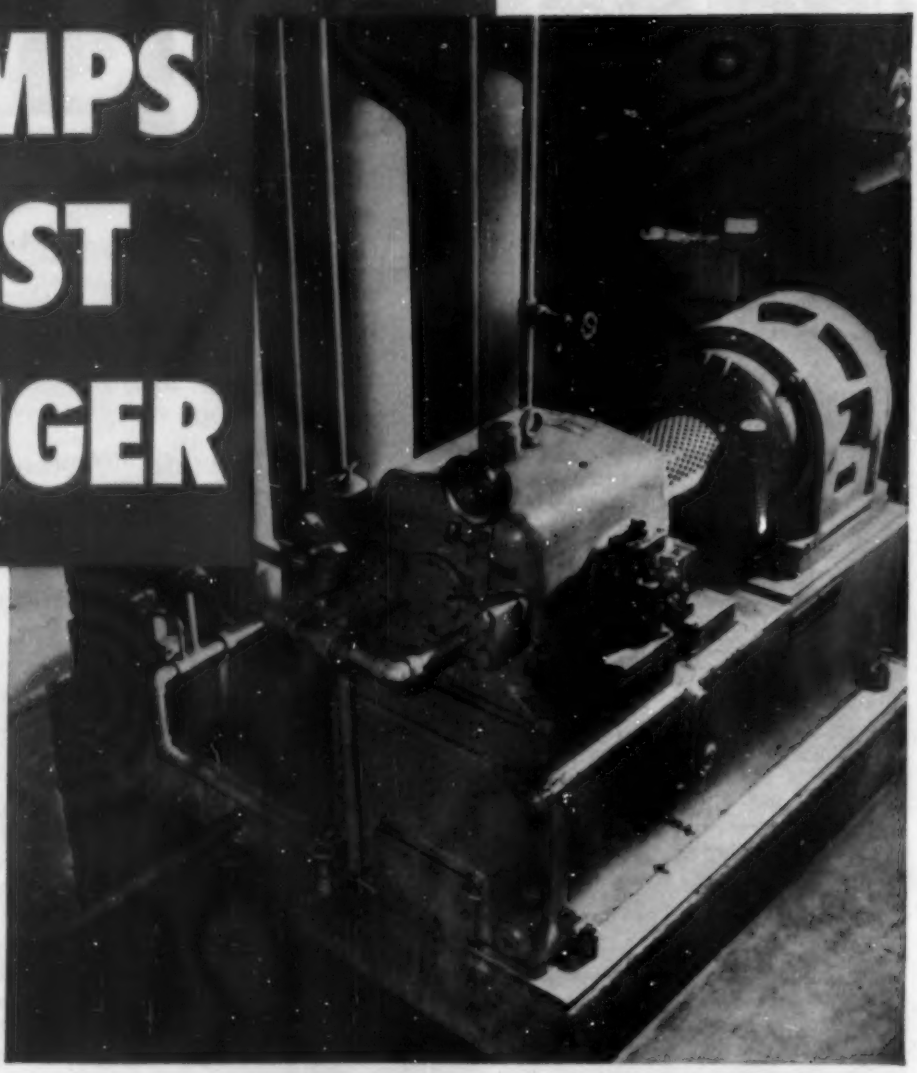

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FOR ALL HYDRAULIC UNITS

Why Not?

In April, I attended the bi-annual exhibition held by The American Society of Tool Engineers in Philadelphia. It is one of the most impressive industrial shows now currently "on the boards" and the number and kind of exhibitors participating made it outstanding.

Even more important is the number and kind of men attending this show as visitors. Over 28,000 registered and more than 21,000 laid down their TWO DOLLARS to get into the show. This in itself guarantees serious intentions of the visitors.

Laced through the exhibitors booths were many, many manufacturers of hydraulic and pneumatic components and complete systems. As a matter of fact, there were enough of these to hold a respectable show of their own and several of these exhibitors spoke to the writer about holding a separate show—now that the FLUID POWER ASSOCIATION is in being and so active.

We do not feel that holding a separate show would be a wise course for many reasons but it seems to us that there would be much to be gained if the responsible officers of the National Fluid Power Association were to buy, in behalf of their members, a large block of space in the next ASTE show so that a separate section could be set aside for all FLUID POWER activities. Such a section would impress the visitor on the size and importance of our industry and the technical importance of FLUID POWER.

There is ample precedent for this suggestion. For many years the American Gas Association has had an arrangement of this kind with the show committee of The American Society of Metals. It has apparently worked very well because the arrangements have endured for so many years. To attend that show and see all the gas people grouped together has always impressed visitors. It could do as much for the FLUID POWER people.

Irving B. Dexter

PUBLISHER

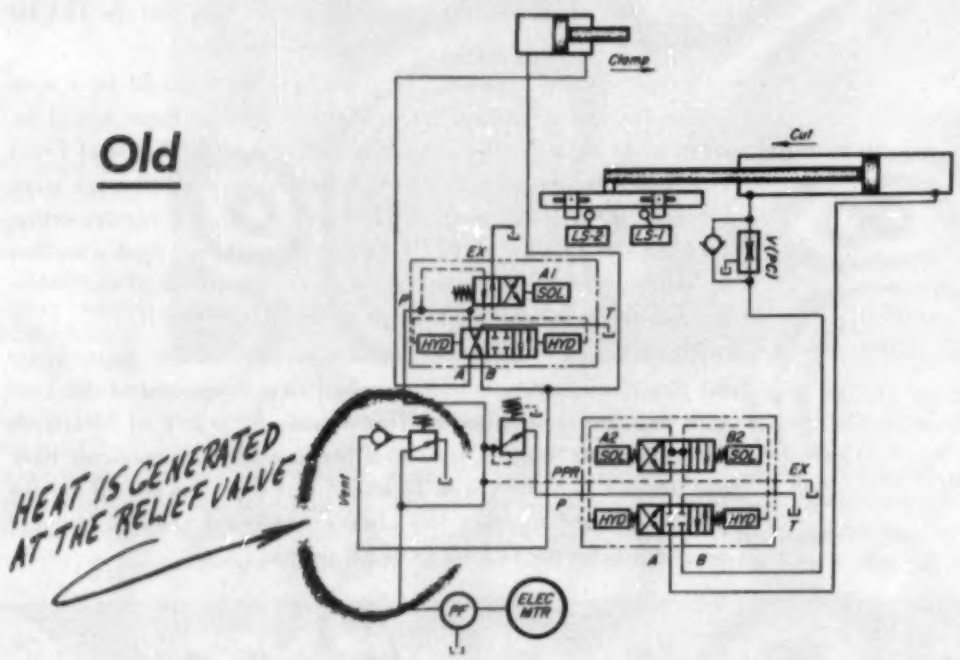
Accumulator Circuit Reduces ...Gives Constant

By C. B. Blake and A. M. Steel
Scovill Manufacturing Company

CYCLE TIME on this cut-off saw is now constant because a source of heat which caused varying oil temperature was eliminated. The revised hydraulic circuit also requires less power.

On this circuit, cycle time varies with oil temperature

Old



Operating Temperature... Work Cycle Time

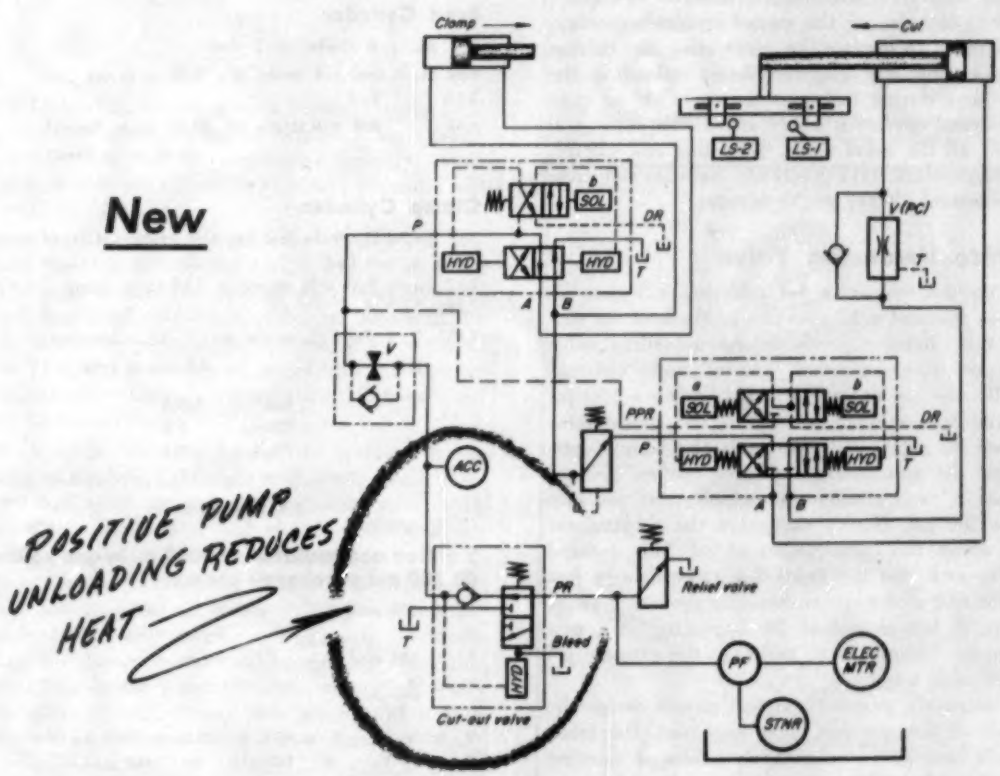
CONSTANT cycle time on hydraulically powered machine tools can often be maintained with reasonable accuracy merely by eliminating speed variations caused by changing oil viscosity. Holding oil viscosity constant requires a constant operating temperature.

The importance of cycle time depends on the machine function. On machines having cutting tools fed by oil power, quality of the machined finish will vary if cutting time changes. Controlled time is also very important on automation equipment where a variation of time at one point in the line will upset the entire movement of parts through the production line. And, of course, on any machine, variable cycles upset production schedules and cause unnecessary concern from the machine operator who is working on piece work rates.

A solution to the problem of changing cycle time caused by oil temperature variation is shown in the accompanying circuits which power a cut-off saw in the rolling mill of Scovill Manufacturing Company.

With the original circuit, it was found that the work cycle on this saw varied with the length of time of operation. After checking the circuit, it was decided

Revised unloading circuit improves machine operation



. . . simple circuit change results in constant oil viscosity

that the difficulty arose from the change in oil viscosity due to temperature rise. A test run was made starting with the oil at room temperature, 75 degrees F. The cycle time against temperature was recorded every 15 minutes for about three hours and plotted as shown on the graph. The time varied from .88 minutes at 75 degrees down to .34 minutes at 150 degrees three hours later. The time desired for production is .34-.35 minutes.

Finding the Heat Source

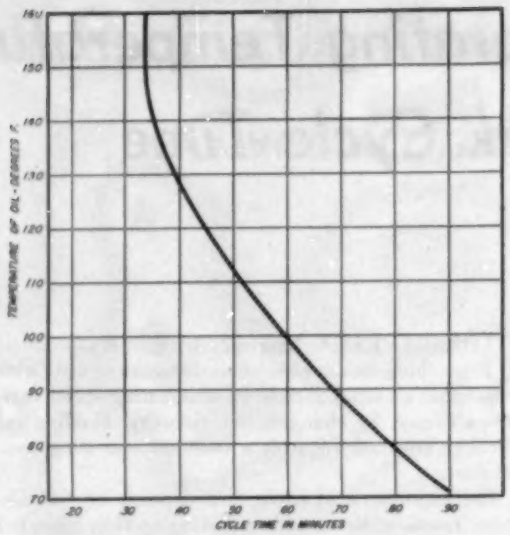
From a quick look at the original circuit, it would appear that this circuit would work properly because a vented relief valve is used to dump the pump volume at very low pressure when the saw is at rest. Under these conditions oil temperature should not increase. What was the source of heat? Further investigation of the machine cycle showed that the loading or idle saw time was only about 10 percent of the total cycle time. This meant that during the feed operation, which is most of the time, the pump volume that is in excess of the meter-out valve setting had to blow-off the relief valve at the maximum relief valve setting. This lost energy was converted to heat causing the temperature of the oil to increase.

To eliminate this heat source, thought was given to methods of reducing the wasted hydraulic energy. It was decided to operate the cycle using the volume from an accumulator and completely unloading the pump volume during the operating cycle. At no time during normal operation would any of the pump volume blow off the relief valve. With this new circuit, the oil temperature stays practically uniform and cycle time is constant all day at .35 minutes.

Accurate Unloading Valve

With the new circuit, a pump having a 5 gpm capacity has replaced a 17 gpm pump. Much of the success of this circuit depends on the unloading valve which must have consistent "cut-in" and "cut-out" points. Because an unloading valve having a 100 psi differential was selected, choice of the accumulator was based on a 100 psi expansion. The pump "cuts-out" after the accumulator pressure reaches 550 psi and "cuts-in" again when the accumulator pressure drops to 450 psi. During expansion the accumulator delivers about 135 cubic inches of oil. This demand volume is such that the unloading valve cuts in just before the end of the cycles therefore the accumulator is always at full charge at the beginning of a new cuting cycle. This helps to maintain the extreme accuracy of cycle time.

By a relatively simple change in circuit design the operation of the saw has been improved, the labor grievances have been eliminated by holding a constant cycle time, and the power requirements have been reduced.



GRAPH shows how the cycle time varied with oil temperature on a cut-off saw having the original hydraulic circuit.

Accumulator Calculations For Pump Unloading Circuit

Feed Cylinder

3½ dia. x 8 stroke — 2 Rod

9.62 sq. in push x 8 stroke = 76.96 cu in cut
3.14 " " Rod
6.48 " " Pull x 8 stroke = 51.84 cu in Retract
128.80 cu in Total

Clamp Cylinder

3½ dia. x ⅛ stroke, cyl has 1½ stroke but is adjustable to ⅛" —1 Rod

9.62 sq in Push x ⅛ stroke = 1.20 cu in clamp
.785 " " Rod
8.835 " " Pull x ⅛ stroke = 1.1 cu in unclamp
2.3 cu in total

Saw	128.8
Clamp	2.3
Pilots	2.5
	133.6 cu in working volume

$\triangle V$ = 133.6 cu in.

5 gallon accumulator = 1050 cu in gas volume @ 300 psi precharge pressure.

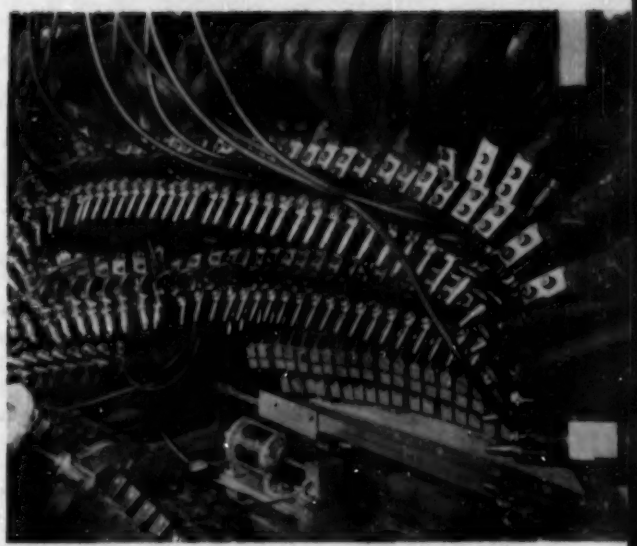
P_1 = 300 p.s.i. V_1 = 1050 cu in
P_2 = ? $V_2 = V_3 + \triangle V$
P_3 = 550 p.s.i. V_3 = ?

$$V_3 = \frac{P_1 V_1}{P_3} = \frac{300 \times 1050}{550} = 573 \text{ cu in}$$

$$V_2 = V_3 + \triangle V = 573 + 133.6 = 706.6 \text{ cu in}$$

$$P_2 = \frac{P_3 V_3}{V_2} = \frac{550 \times 573}{706.6} = 446 \text{ p.s.i.}$$

P_2 = 446 p.s.i.



SEQUENCE CONTROL

. . . on multispot welders

By John Sant

AUTOMATIC timing of work positioning and locking, and actuation of 134 weld guns, on a multispot welder built for the automotive industry, is accomplished with electrically controlled pneumatic and hydraulic circuits.

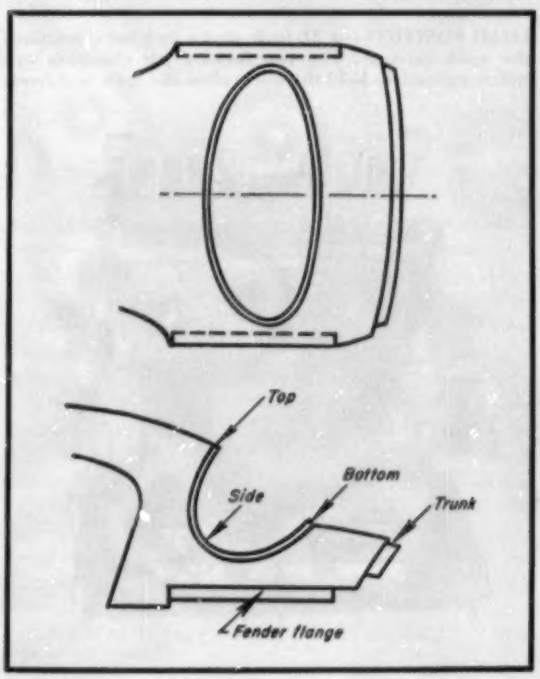
From the design studies made by engineers at The Federal Machine and Welder Co., it was decided that the 134 guns needed for welding an automobile roof and window reinforcement assembly, as shown in the sketch, would be arranged to operate in six separate banks. This was necessary to avoid gun interference and at the same time distributing the electrical load on the 34 transformers.

The finished machine houses the welding transformers, work holding fixture and clamp, and independent hydraulic and pneumatic systems along with the necessary mechanical and electrical controls for efficient operation and safety.

It was decided to clamp the work and lock the work holding fixture with air powered cylinders because the necessary holding forces could be easily developed by shop air pressure and space permitted using the required 2½, 3 and 4 inch diameter clamp and locking cylinders. Simplicity and cost favored the use of pneumatics for these secondary operations.

Oil power is supplied by a 34 gpm, 1000 psi vane type pump to the carriage, expanding dies, and weld gun cylinders. The carriage cylinder has a 3½ inch bore and 28 inch stroke and acts to position the work fixture between the loading and welding positions.

THE JOB—134 spot welds are required on this automobile roof and rear window reinforcement assembly.



JOHN SANT, Chief Draftsman, The Federal Machine and Welder Company, Warren, Ohio.

Hydraulic and pneumatic circuits are similar on a machine having 13 or 130 spot weld guns. However, more complex timing problems may be presented by the use of a large number of guns.

There are also two expanding die cylinders, having 3 in. bore and 2 in. stroke. The expanding stroke is necessary to load and unload the parts being welded.

Hydraulics is required for these operations because of the loads which must be handled. Spacing the 134 spot weld guns on extremely close centers (1⅝ to 2⅜ inches) meant that the cylinders powering the guns must have a small bore. They were designed with a 1¼ inch bore.

Complete automatic operation from load to unload is provided by position actuation of limit switches and a cam timer. After the operator has loaded the work of the carriage, he operates a hand air valve which clamps the work in position. He then operates a hand hydraulic valve which expands the inner dies on the carriage. The clamps and dies will operate safety limit switches. The sequence start button is pressed to set up the automatic cycle. When the carriage has moved into the welding position, a limit switch, tripped by carriage movement, energizes the air operated locks to lock the carriage in position under the welding guns. Movement of the locks closes limit switches which start the cam timer.

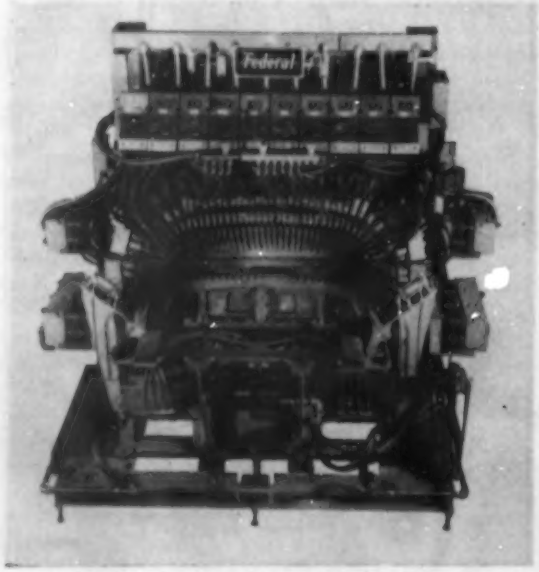
As the cam timer turns, the welding guns are brought into contact with the work. After the six welding sequences have been made, a cam on the timer releases the air operated locks. Retraction of these locks open two limit switches to cause retraction of the carriage. When the carriage has returned to starting position, a solenoid operated unloading valve is deenergized to vent the main relief valve and dump the pump volume at low pressure while the work fixture is being unloaded and loaded. This cycle is repeated approximately every 40 seconds.

Pressure control on a spot welding machine is critical. The use of fluid power provides simple regulating methods. A pressure relief valve at the pump outlet permits adjustment of the maximum pressure to be supplied by the pump. To further regulate the pressure on the cylinders independently from pump pressure on the carriage cylinder, a pressure reducing valve is placed in the supply line to the guns.

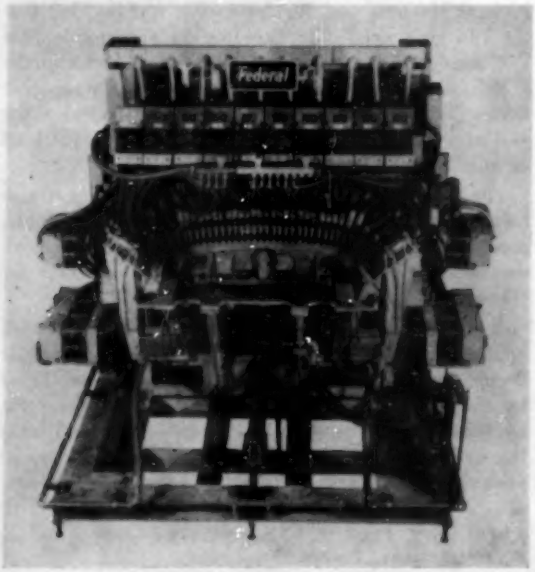
Because the six groups of weld guns do not operate simultaneously, it was necessary to provide some means of preventing a drop in pressure between the operation of the individual gun banks. This was done by installing a 2½ gallon accumulator after the pressure reducing valve in the supply line to the weld guns.

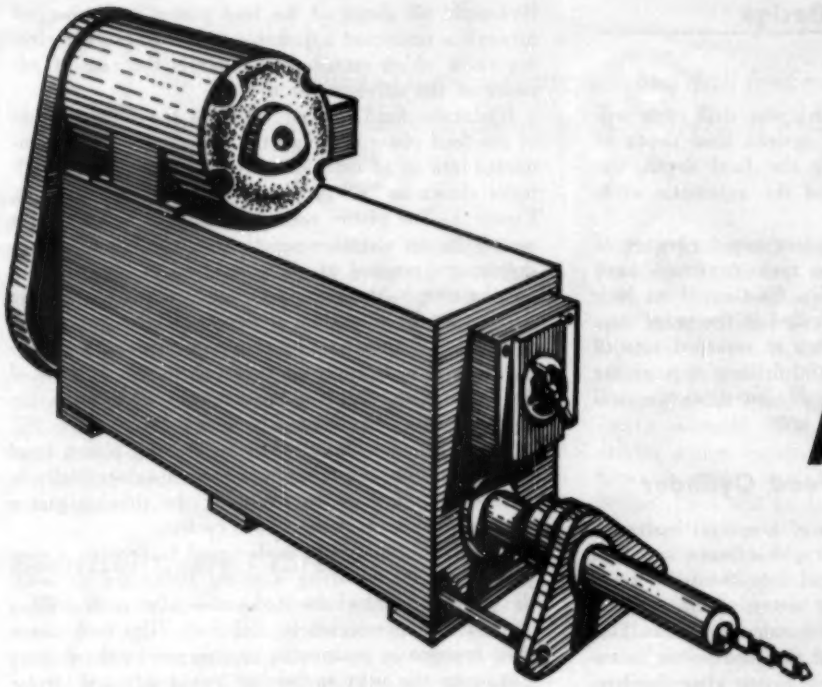
The basic design ideas used on this 134 gun machine are much the same as those applied to welders having far fewer electrodes. However, use of so many guns did present the designer with some timing and space problems which had to be solved by careful machine layout.

LOAD POSITION—a 28 inch stroke hydraulic positions the work carriage. The two forward air clamping cylinders operate to hold the work when the cycle is started.



WORK POSITION—the carriage is moved into the machine. The complete cycle is controlled electrically. Operation of the hand valve on the right is used only during setup to position the dies.





Hydraulic Drill FEED DESIGN

By Paul Romine and Andrew Armstrong

Here's an entirely new electro-hydraulic circuit design for obtaining adjustable, positive feed on deep hole machine drilling. Control of a unique combination rapid traverse and feed cylinder makes possible adjustable step drilling from zero to one inch. The circuit is set so that drill feed changes from rapid approach to fine feed .015 inch before each drilling step.

ONE troublesome production problem has been the drilling of deep holes. An example is in the fabrication of automobile crankshafts where the hole drilling is comparatively deep with respect to its drill diameter. Drilling of such pieces requires a series of drilling steps of progressively increasing depth. After each step, the drill is withdrawn from the hole both to cool the drill and to clear the hole of chips. A new electro-hydraulic drill feed mechanism has been developed to perform such deep drilling operations.

The drill feed device is designed to automatically advance the drill rapidly towards the work, then to retard the rate of advance of the drill just before it engages the workpiece, and to advance the drill at the adjustable retarded rate in a drilling step until the hole is drilled to a predetermined depth approximately equal to its diameter. Rapid withdrawal of the drill will then take place to clear the hole of chips and to permit

This design is protected by U.S. Patent 2631480, other patents are pending.

coolant to flush the drill tip. This step drill cycle will automatically repeat until the desired final depth of the hole is reached. Reaching the final depth, the drill is rapidly withdrawn and the automatic cycle stops.

The second and each succeeding rapid advance of the drill during the automatic cycle continues until the drill approaches to within a fraction of an inch from the bottom of the hole drilled in the prior step. The length of each drilling step at retarded rate of advance is the same as the initial drilling step, giving a positive feed step, which greatly increases the drill life and accuracy of the drilled hole.

Rapid Advance and Feed Cylinder

To obtain this drilling action, a special hydraulic and electrical circuit controls rapid advance and feed pistons. The drill is fed to and into the work by a hydraulically operated driving piston within a cylinder and feed piston within the same cylinder. This mechanism is designed so that the feed piston is engaged and driven by the driving piston after the driving piston has completed its rapid advance stroke. Hydraulic oil ahead of the feed piston is discharged through a restricted adjustable high resistance metering valve which retards and controls the rate of advance of the driving piston.

Hydraulic fluid discharged from the forward side of the feed piston through the metering valve is conducted into an adjustable receiving accumulator or cylinder shown as "F" in the hydraulic circuit drawing, Figure 1. The piston rod of cylinder "F" engages a switch in an electro-magnetic circuit. When a predetermined amount of oil is received in "F" to actuate the switch, the electromagnetic circuit is effective to reverse the direction of valve "A" by energizing solenoid "B" causing a reverse movement of the driving piston, also applying pressure to the bottom of "F". The withdrawal of the driving piston from the driven piston simultaneously opens dump valve "C" to drain. Upon withdrawal of the driving piston from the feed piston, the latter will remain substantially in position to be engaged again by the driving piston upon a repetition of the above cycle.

The hydraulic circuit is designed to provide a simple means for assuring a slight backward or withdrawal movement of the feed piston after each drilling step of the approximately .015 inch. The feed piston then remains in position to be engaged by the driving piston on the next succeeding rapid advance stroke. The backward or withdrawal movement of the feed

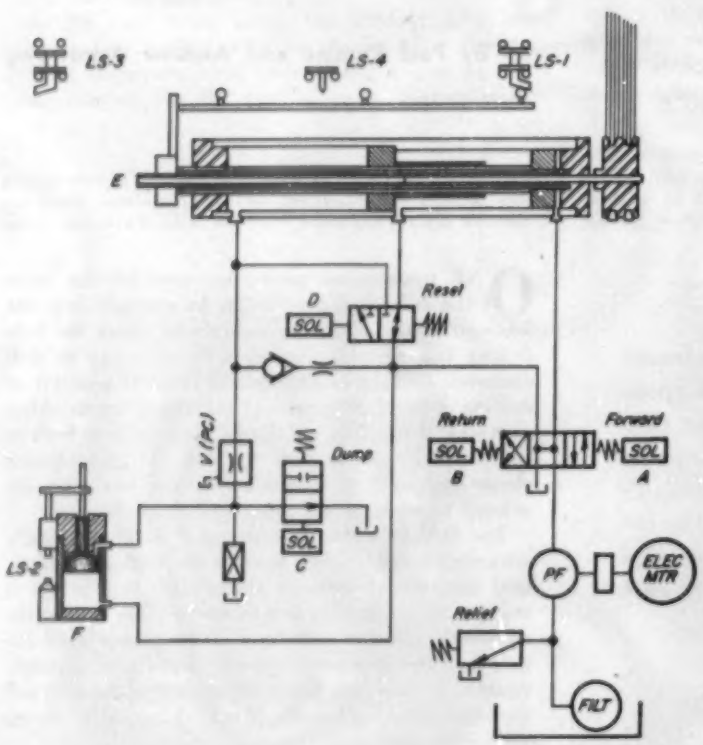


FIG. 1. HYDRAULIC CIRCUIT— After rapid approach the driving piston engages the feed piston and oil metered out of flow control valve then regulates the feed rate. Distance of cutting feed is controlled by the adjustment of piston in cylinder F.

Automatic cycling of the rapid approach and drill feed cylinder is controlled by limit switch actuated, solenoid operated hydraulic valves.

piston is accomplished by introducing through a restricted orifice a small volume of hydraulic fluid into the forward side of the feed piston during each withdrawal movement of the driving piston. Then upon the next succeeding rapid advance stroke of the driving piston, the driving piston will engage the feed piston approximately .015 inch before the drill engages the workpiece as determined by the size of the orifice. Accordingly, the rapid advance movement of the drill toward the workpiece will be cushioned and retarded before the drill strikes the workpiece.

Electrical Control Circuit

This entire cycle is controlled by the electrical circuit shown in Figure 2. With the driving cylinder in the returned position, pressing the start button energizes relay CR-1. Contacts CR-1 will close to energize CR-2 which will actuate the forward solenoid "A". The driving piston will move forward to rapidly advance the drill. At the end of the rapid advance stroke the driving piston will engage the feed piston. Feed rate will be controlled by the hydraulic metering valve. Distance of feed is determined by the adjustment of cylinder F. Feed will stop when LS-2 is tripped to deenergize CR-2 and solenoid "A", and energize CR-3, return solenoid "B" and dump solenoid "C". The driving piston rapidly returns and trips LS-1 to start forward stroke again. After the complete hole is drilled, LS-3 will be tripped to deenergize CR-1 and energize CR-4 which actuates reset solenoid "D" to return the feed piston. Upon return of the feed piston LS-4 will be tripped to deenergize solenoid "D" completing the cycle.

The electrical circuit also includes protection against a dull or broken drill. Overload contacts will open to cause reset of the feed and driving piston. The emergency return acts in the same manner as closing LS-3.

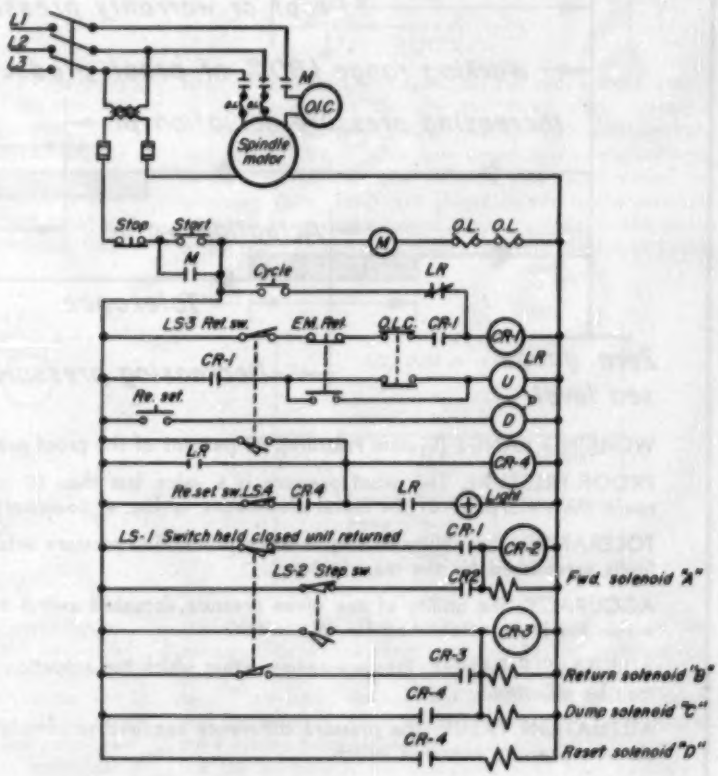


FIG. 2. ELECTRICAL CIRCUIT—After the start button is pushed the drill will feed in and out of the work automatically in steps until LS-3 is contacted to cause final withdrawal of the drill.

3 PRESSURE SWITCH controlled Accumulator Circuits

By Rupert P. Esser

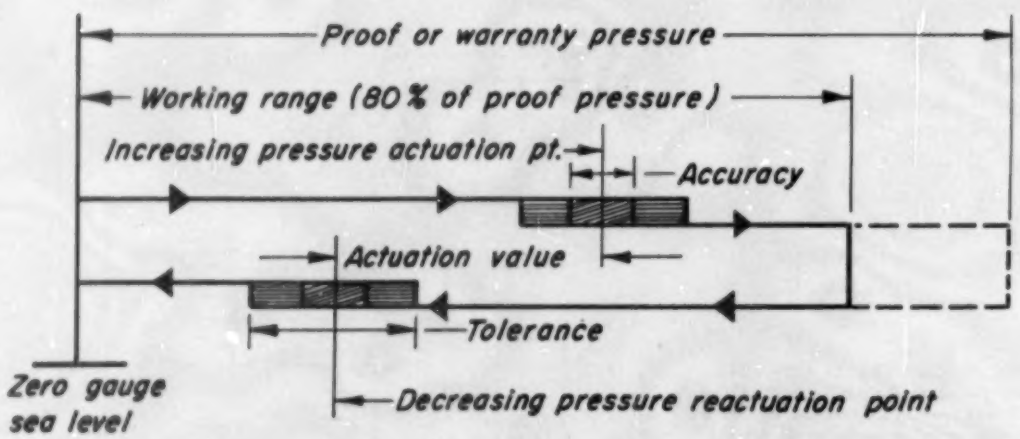
ONE of the more common applications of pressure switches in a hydraulic circuit is to cause the pumping action to stop and start in response to the pressure changes in the accumulator.

While there are many applications where a fixed and non-adjustable actuation value or differential (difference between cut-in and cut-out pressure) are entirely satisfactory, there are other cases requiring considerable range of adjustment of the actuation value. This can be accomplished by either using two pressure switches, each with a fixed actuation value, or using a single unit with two switch elements having fixed actuation value but being individually adjustable.

Three methods of applying pressure switches for this purpose are shown in the accompanying circuits. The selection of the method used depends on whether it is desired to start and stop the motor driving the pump or to unload the pump either with a solenoid vent valve attached to the relief valve, or with a solenoid dump valve.

RUPERT P. ESSER, TEC Engineering Corp., Logansport, Ind.

Pressure Switch Terminology



WORKING RANGE (System Pressure). 80 percent of the proof pressure of a pressure actuated switch.

PROOF PRESSURE. The proof pressure is a value less than 80 percent of the pressure required to reach the yield point of the metal diaphragm, spring, or Bourdon tube.

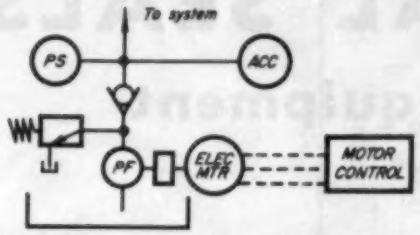
TOLERANCE. The ability of two or more production pressure actuated switches to operate within the limits established by the manufacturer.

ACCURACY. The ability of any given pressure actuated switch to consistently repeat its operation within the limits established for this switch.

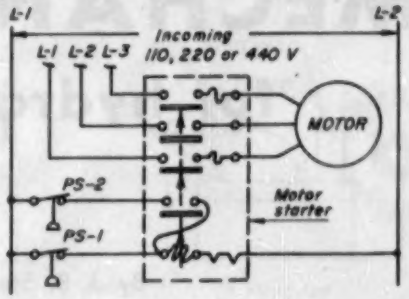
ADJUSTABLE RANGE. Pressure range within which the actuation value of a pressure actuated switch may be adjusted.

ACTUATION VALUE. The pressure difference required to complete the actuation and reactuation cycle of a pressure actuated switch.

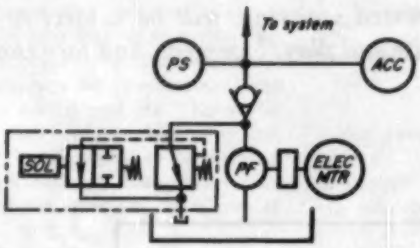
Courtesy Barksdale Valves



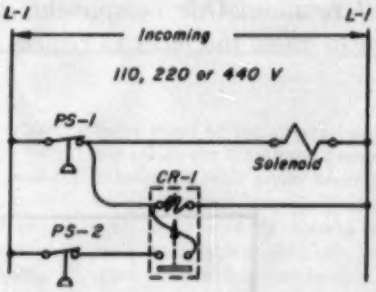
1. The electrical wiring diagram shows the method of starting and stopping the pump motor through a pressure switch which has two individual adjustable switch elements or through two pressure switches which each have a fixed actuating value. In this circuit, both switches are normally closed. PS-1 is set to close at the low cut-in pressure; PS-2 is set to open at the high cut-out pressure. Opening of PS-2 stops the drive motor; closing of PS-1 starts the drive motor. Starting and stopping the electric drive motor is not advisable



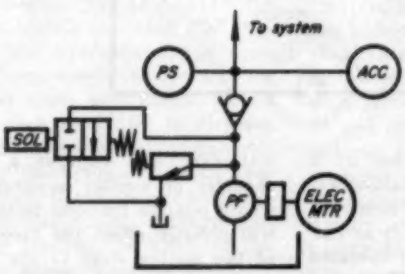
when the cycle repeats frequently because the very frequent motor starting or inrush current, usually much higher than running current, will cause excessive heating of the motor windings. Also there is no appreciable power savings to be had by stopping the drive motor for only brief intervals.



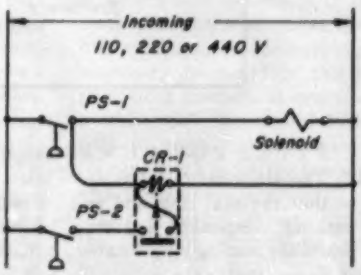
2. Unloading the pump volume through a solenoid operated normally open vent valve is an efficient method. This may be a separate valve or built into the relief valve. Referring to the electrical circuit, both pressure switches are normally closed. At the adjustable low pressure cut-in setting PS-1 closes to energize the solenoid which closes the vent valve. Pump is now delivering oil to the system and pressure will build up in the accumulator. As the pressure increases, nor-



mally closed PS-1 will open, but the vent valve solenoid is held energized through the relay until normally closed PS-2 opens at the adjustable high pressure cut-out setting. Vent valve now opens and pump delivery is directed to the tank through the relief valve. As pressure falls, PS-2 will close; however, the solenoid will not be energized until pressure falls to the actuating point of the PS-1 which controls the cut-in point.



3. Sometimes it may be preferable to use a normally closed dump valve which requires solenoid energization for dumping. In this circuit PS-1 and PS-2 are normally open. At the adjustable high pressure setting PS-1 closes to energize the solenoid which opens the dump valve. The accumulator now supplies oil to the system until the pressure has fallen to the low pressure setting of PS-2 which opens to deenergize and close

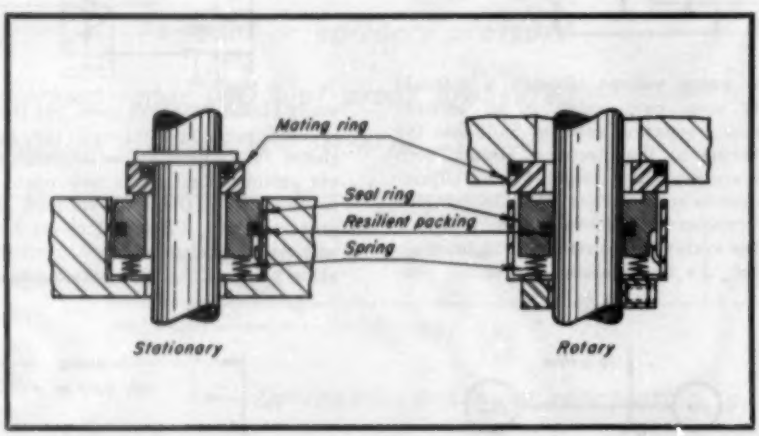


the dump valve. The pump then delivers oil to the accumulator and system, and builds the pressure up again. While PS-1 opens before the pressure has fallen to the low limit, the solenoid is held through the relay and deenergized when PS-2 opens. On rising pressure, PS-2 closes before the high pressure limit is reached but the solenoid is not energized until PS-1 closes.

MECHANICAL SEALS
for hydraulic equipment

By J. B. Stevens and Harold F. Greiner
Sealol Corporation

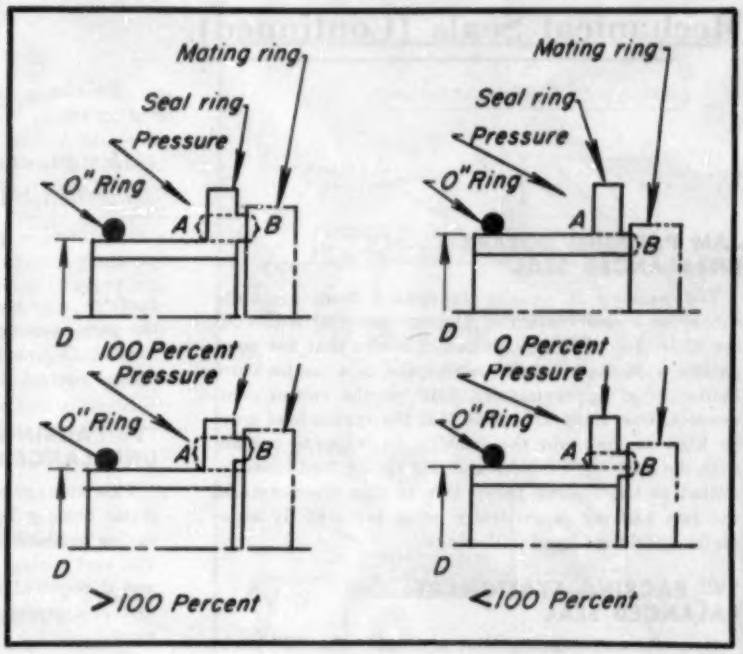
The mechanical seal consists of two flat sealing faces making contact at right angles to the axis of rotation. One component, the flexibly mounted seal ring, will be subject to axial motion to allow the faces to remain in contact despite end play, face wear, and face run-out.



BASIC TYPES FOR PUMP SHAFTS. The stationary seal is designed so that the seal ring and resilient packing component are stationary while the mating ring rotates with the pump shaft. On a rotary seal the seal ring and resilient packing rotate while the mating ring is stationary.

An advantage of the stationary mechanical seal is the absence of centrifugal forces affecting the flexible seal ring. In this assembly the mating ring is the only rotating member and this is usually rigidly attached to the shaft either by a clamping action or overbalanced hydraulic forces holding it firmly in place. This is quite necessary as stationary seals are frequently operated at speeds of 15,000 fpm and over on shafts or 3 or more inches diameter. Because the rotary mechanical seal is, subject to centrifugal forces, it is not usually used on high speed service. Its principal advantage lies in the relative ease with which it may be attached to straight shaft sections.

The mating ring component of the stationary seal requires a backup shoulder or similar locating device whose relative trueness to the shaft will directly affect the face runout of the mating ring. In the case of the rotary seal, the mating ring is retained in the housing which can usually be more readily machined to maintain the locating shoulder in a true plane. Since the rotating seal ring is the flexible member it will be positioned by the mating ring face and the seal itself can easily be locked by set screws, friction fits, or similar means, on a smooth shaft.



HYDRAULIC BALANCE. Where high pressures are involved, it has been found that reducing the contact face unit loading to a value below the pressure sealed, will materially improve seal performance and increase useful seal life. This variation in face contact pressure or unit loading is accomplished by varying the ratio between the contact face area and the effective piston area of the seal ring.

We find it convenient to express the hydraulic piston area as a percentage of the contact face area. This percentage is the "overbalance". No practical seal is entirely balanced, but only partially so. The percentage of overbalance indicates the actual average unit face load, neglecting the spring load, as a percentage of the hydraulic pressure sealed.

The drawings show various face arrangements. "D" indicates the effective sealing diameter; "A" represents the hydraulic piston area, and "B" represents the contact face area. For 100% overbalance, all the contact face area "B" is disposed above the effective sealing diameter "D" and the hydraulic piston area "A" is equal to the contact face area "B". For this design, average contact face load will be 100% of the hydraulic pressure sealed.

For 0% overbalance, all the contact face area "B" is disposed below or inside the effective sealing diameter "D". Hydraulic piston area "A" is then 0. This means that there is no hydraulic force holding the face closed and such a seal would depend entirely on its spring to maintain the seal faces in contact.

For greater than 100% overbalance all the contact face area "B" is disposed above the effective sealing diameter "D" and the hydraulic piston area "A" is greater than contact face area "B". The unit contact face loading will actually be higher than the hydraulic pressure being sealed by an equivalent percentage. This is the condition existing with most "unbalanced" Rotary type seals where the shaft is utilized as the effective sealing diameter.

The fourth drawing shows the relationship of most "balanced" seals. Here part of the contact face area "B" is disposed outside of the effective sealing diameter "D" so that the hydraulic piston area "A" is less than contact face area "B". The common area ratios and hence, overbalance percentages, will vary between 60 and 90% depending on the seal selected and will differ for specific applications.

All unbalanced seals, as they are usually called, will be in the group having an overbalance of 100% or greater and all balanced seals will be in the group having an overbalance value less than 100%.

The unbalanced seal will be limited to low pressure application while the balanced seal is normally necessary for high pressure service. Due to other variables affecting operation no fine line can be drawn specifying pressure ranges for each type. Some users of seals have established 100 psi as the maximum pressure for unbalanced seals under average service conditions. This limit can, however, be increased considerably if good lubricating mediums or low shaft speeds are involved.

THE RESILIENT PACKING member is subject to several stringent requirements. Primarily it must seal the area it encloses without leakage. It must not provide too great a restriction to the flexible seal ring to either pivot about its axis or to slide axially while the seal ring maintains face contact. It must not add materially to the face loading of the seal, either due to its own resiliency or due to spring loads necessary to maintain the packing in sealing contact. It must be compatible with the media in contact with it, under the anticipated service conditions including temperatures and pressures.

The principal devices utilized as the packing components are jam packings, "V" or "U" type packings, conventional "O" rings, rubber bellows, rubber diaphragms, metal bellows, metal diaphragms and piston rings. All of these types of packings with the exception of the diaphragms are readily adapted to either "balanced" or "unbalanced" seals and to either stationary or rotating seal applications.

Mechanical Seals (Continued)

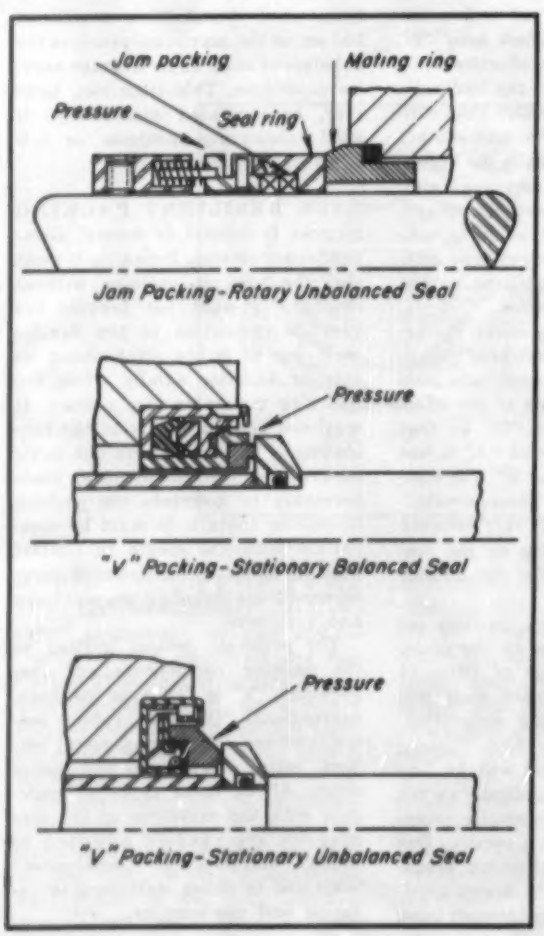
Design, and application of eight types of mechanical seals for hydraulic equipment

JAM PACKING ROTARY UNBALANCED SEAL

The packing is usually fabricated from synthetic rubber or a combination of fiberous material with rubber filler. Its service is limited to media that are compatible with the synthetic rubber and to a temperature limitation of approximately 300F on the rubber components. One disadvantage is that the spring load must be high to maintain the packing in intimate contact with the adjacent surfaces and this spring load is transmitted to the sealing faces. Due to this disadvantage, the jam packing is generally being replaced by automatic "packings" and "O" rings.

"V" PACKING STATIONARY BALANCED SEAL

Here the same spring that maintains the "V" packing in the intimate contact with the adjacent sealing surfaces, also holds the sealing faces in contact. Unlike the jam packing, only light loads are required on the flexible "V" sealing lip, hence, face loading does not exceed normal limits.



"V" PACKING STATIONARY UNBALANCED SEAL

This arrangement provides a clamping action on the static sealing lip to maintain the seal, and a garter spring produces a radial load on the sliding sealing lip. The seal spring, therefore, does not act on the packing and it required only to maintain the seal faces in contact and overcome frictional resistance to axial movement.

The "V" ring type packing is normally manufactured from one of the synthetic rubbers or silastics, and in addition, many special designs are fabricated from Teflon, Kel-F, Polyethylene and similar plastics. One of the advantages of the "V" ring seal design is the ease with which these various materials can be used as the packings by either molding or cutting to size. This assists standardization and affects economies in production. The use of seals of this type will again be limited to those media in which the synthetic rubber or silastics are compatible and within accepted temperature ranges. In the case of the Teflon or Kel-F, the packing is suitable for use in most medias and operating temperature may be extended to approximately 500F. The main disadvantages of the Teflon and Kel-F "V" rings are primarily due to their relative stiffness and lack of resiliency, which despite thin sections and careful fabrication make it difficult to insure a tight seal.

"V" ring or "U" ring seals are often used at pressure in excess of 300 psi, however, in the higher ranges difficulties are sometimes experienced with packing extrusion, twisting of the packing ring, and excessive packing drag due to cold flow under high pressure conditions.

"O" RING-ROTARY BALANCED SEAL

"O" rings are utilized for both the dynamic packing between the seal and seal sleeve, and for the static packing between the seal sleeve and shaft, and the mating ring and housing. The advantages of this seal are simplicity and reliability so long as the "O" rings are not damaged. They are particularly useful under high pressure conditions and many seals are in service at pressures up to 2000 psi. The principal disadvantage is that use is generally limited to service requirements compatible with the synthetic rubber or silastic "O" rings. Teflon "O" rings are produced and available; however, their lack of resiliency has limited their acceptance in dynamic or moving applications.

RUBBER BELLOWS-ROTARY UNBALANCED SEAL

Rubber bellows and rubber diaphragms seals are basically similar except that in the case of the bellows a flexible rubber member is disposed axially, and with the diaphragm, the flexible rubber member is disposed radially. By adjusting the bellows supporting diameter, a balanced seal may also be devised and this version is sometimes utilized in intermediate as well as low pressure ranges. Its advantage is its extreme flexibility and in some media where rubber swelling is prevalent, the bellows seal is usually less affected than the "O" ring or "V" ring seal, because high volume swell will not normally restrict the action of the bellows.

Its disadvantage is its dependency on thin rubber sections to restrain hydraulic pressure and a tendency to concentrate flexure at a single point. Either condition can induce rupture of the bellows.

RUBBER DIAPHRAGM-STATIONARY UNBALANCED SEAL

The diaphragm seal is limited to very low pressure as the contact face loading overbalance is either considerably greater than 100% where the pressure is on the back side of the bellows or negative if the pressure is on the front side. In this latter case the spring must overcome the negative overbalance and provide sufficient contact face loading to maintain a tight seal. Under low or negligible pressure condition this design provides a simple and effective seal.

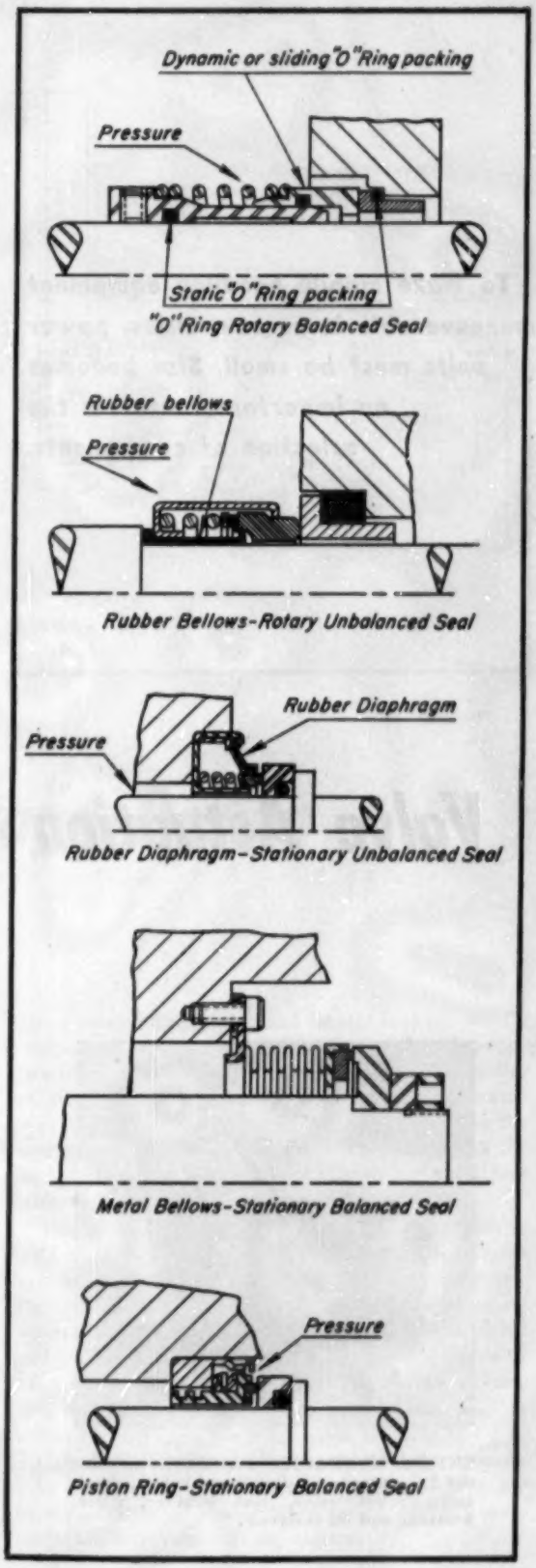
METAL BELLOWS-STATIONARY BALANCED SEAL

Principal advantage of the metal bellows seal is the inclusion of all metallic elements, hence, it can operate under conditions where synthetic elastomers are unsatisfactory due to either temperature conditions of 600 and 700F are now in service. Because of its simplicity it is also frequently used under lesser service conditions, particularly in smaller sizes where it can be economically produced in quantity. Its disadvantage is the high spring rate developed by the bellows, which necessitates close assembly tolerances to maintain face loads within practical limits. In addition, each size bellows is limited by a definite hydraulic pressure range compatible with the strength of the metal of construction which in the larger bellows sizes confines its use to relatively low pressures.

PISTON RING-STATIONARY BALANCED SEAL

The piston ring type seal is one of the more recent developments for high temperature service. These are now in service operating at ambient temperatures up to 700F. Some slight leakage past the piston ring must be acceptable, as the piston rings are not normally drop tight. Within this limitation the basic design is developing rapidly and an interesting future is expected for this seal in high temperature service.

This article is based on a paper presented at the October, 1953 National Conference on Industrial Hydraulics.



To make mobile handling equipment maneuverable in narrow aisles, power units must be small. Size becomes an important factor in the selection of components.

Valve Actuation with Rotary Solenoids

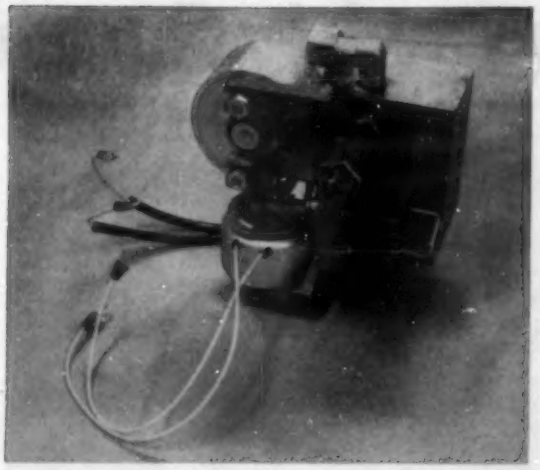
ENTIRE HYDRAULIC PACKAGE includes the 1.5 gpm pump, directional valves, check valve, relief valve, line strainer, filter, breather and oil reservoir.

By Bernard B. Becker

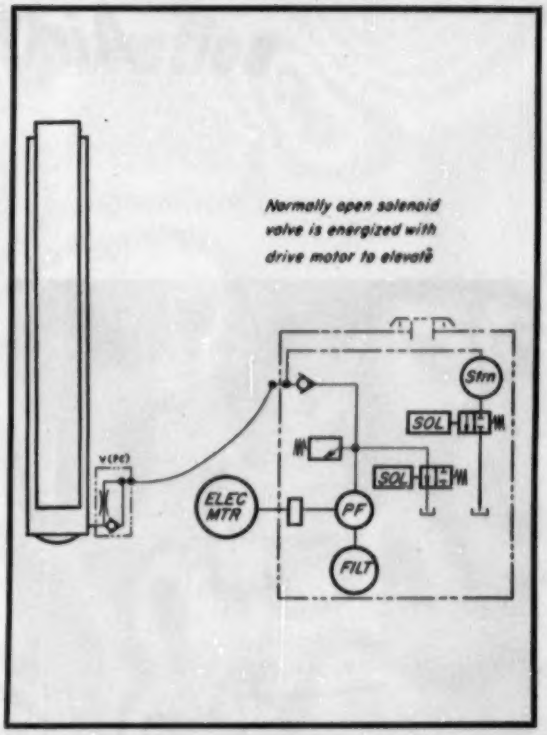
DESIGNERS of the hydraulic power unit used on the Lewis-Shepard Master JackStacker solved one of their space problems by selecting rotary solenoids to operate the system's 2-way valves.

Each rotary solenoid provides the mechanical power to shift the valve plunger. The rotary solenoid drive has a short linear stroke solenoid with the moving member supported from the stationary member on three ball bearings which travel in inclined ball races or grooves. When the coil is energized, the moving member, or armature, is drawn into the coil; at the same time, the inclined ball races cause the armature to rotate. To use this rotary motion to push the linear moving valve plunger, a small eccentric cam is placed over the solenoid shaft. The cam acts against the valve

BERNARD B. BECKER, Chief Hydraulic Engineer, Lewis-Shepard Products Inc., Watertown, Mass.



VALVE ASSEMBLY shows the actuating mechanism. Rotary motion of the solenoids provides a camming action on the valve plunger.



HYDRAULIC CIRCUIT IS extremely simple to provide up, down and hold control of the vertical single acting ram.

Permits Compact Package Design

plunger. The accompanying valve assembly photograph clearly shows the resulting compact design.

Control of the lift cylinder and elevating carriage is from pushbuttons located on the operating control handle. High pressure, 3000 psi, operation for maximum load was selected because of the size advantage this pressure offers. The lift cylinder, valves and lines can be made smaller and the oil capacity can be reduced. The power package has a piston pump delivering 1.5 gpm when driven by a 12 volt DC series wound motor at 3000 rpm. This high speed drive is another means of holding down the physical size of the pump while still obtaining the desired volume.

The hydraulic unit, measuring approximately 12 in long, 8 in wide and 10 in high, includes pump, filter, breather, and oil level window, line strainer and valve assembly. The valve assembly manifolds to the wall of the unit and is submerged in the 460 cubic inches of oil which supplies the single acting hoist cylinder.

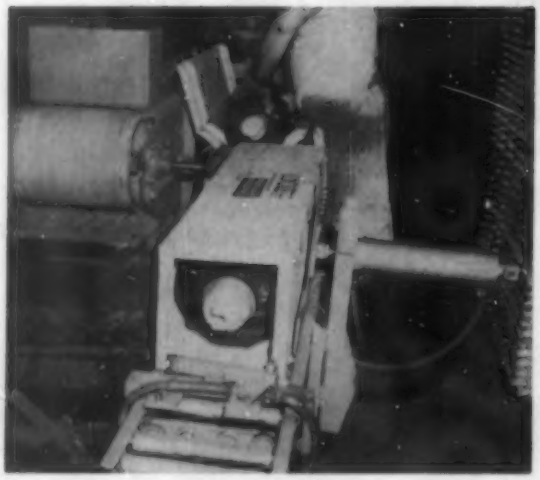
This design completely eliminates the customary pump suction line, piping and fittings between control components, and a number of valve sealing elements. Seated type valves are used to preclude any possibility of settling of the load even after years of constant operation. The pressure relief valve is adjusted to the correct value and sealed at the factory to protect the JackStacker structure, motor and system against possible overload.

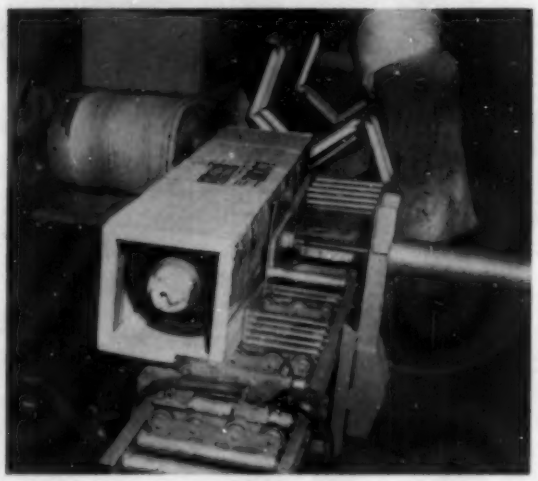
The hydraulic lifting ram has a plunger which is guided at both ends by closely fitting replaceable bronze guides to absorb load and protect packings. Packings are spring loaded to automatically take up wear. Plunger is precision ground, hard chrome plated and polished. Load compensating type flow regulator valve gives uniform lowering speed regardless of load.

A 4000 pound capacity unit raises a full load at a speed of 10 fpm; lowering speed is 30 fpm.

Operation of hydraulically operated clamps, rotaters, side shifters and other attachments is provided for by the addition of one or more rotary solenoid operated four way valves to the system.

Air Powered Jig Tilts and





TRANSFERRING FILLED BOXES from the packaging jig to a storage conveyor is easily accomplished with this equipment. Using a foot control of an air cylinder, the operator tilts the loading section of the conveyor. After loading the insulators, the wire-bound container is closed and the conveyor section is lowered. The crate is rolled onto an adjoining conveyor, clearing the jig so that the packer can start working on another string of insulators immediately. From this point, movement is completely automatic.

Air Circuit Operation

Boxes are held in the jig by raising roller conveyor 45° making 90° V with back rest. When packed and closed, foot valve (A) is reversed and air returns conveyor to horizontal position. Belt moves packed box over rollers (B) until end of box hits air control valve (C). This actuates air cylinder (D) which pushes plate (E) with skate wheels mounted below level of rollers (B). When end of stroke is reached by air cylinder (D), air control valve (F) which is mounted solidly to frame of conveyor, actuates air cylinder (G) which pushes box off skate wheels onto a storage conveyor. Thus, changing the axis of the box 90° allowing storage on the conveyor with the length of the boxes across the conveyor. When the box clears this transfer, this allows air valve (C) to return to position and retracts piston of cylinder (D) which in turn releases valve (F) and pusher piston returns in cylinder (G) ready for next transfer.

Turns For Packaging Operation

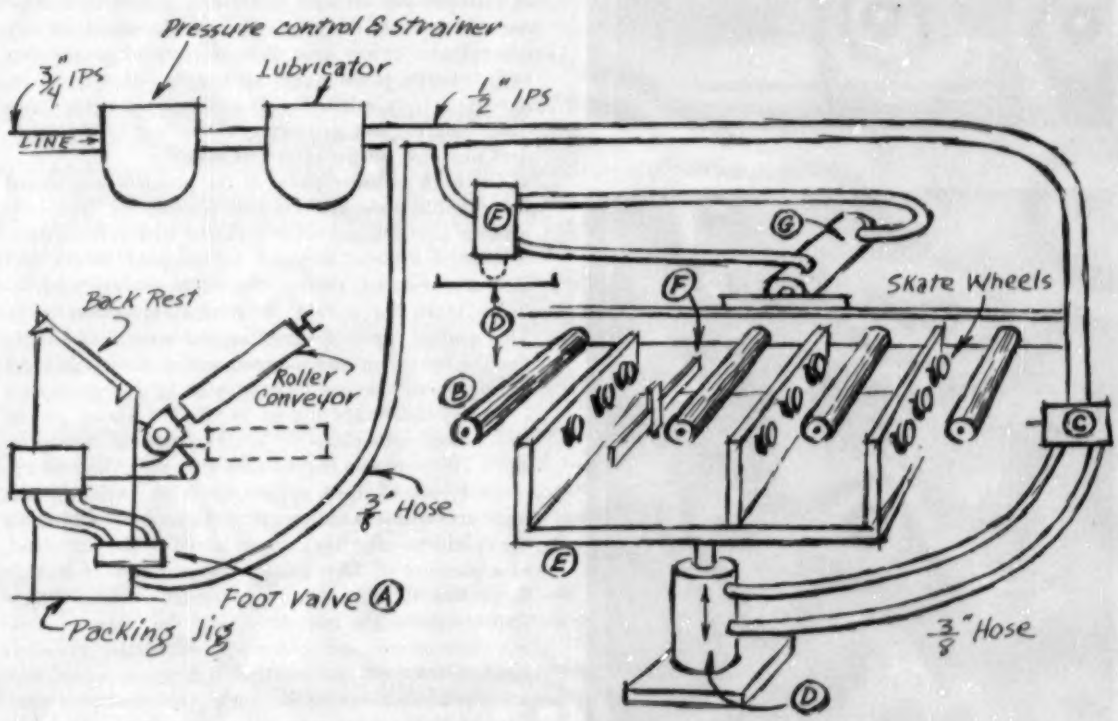
AN unusual jig used in packaging high tension line suspension insulators at Locke Department of General Electric Company, Baltimore, has been an important factor in the success of their packaging and handling system. The jig consists of a section of gravity roller conveyor with a back plate welded at right angles to the ends of the rollers. A foot operated air piston raises and lowers the side of the jig nearest the packer as required. In raised position, the rollers and back plate form a perfect 90° V into which specially designed wirebound mats can be set for packaging of the suspension insulators.

Boxed insulators move from the packaging line to a temporary storage conveyor and then to a more permanent storage area in the yard where they await shipment. After a box has been pushed off the packing jig, a slowly turning power roller pulls it along until it gently bumps an air valve which activates an air cylinder under the conveyor.

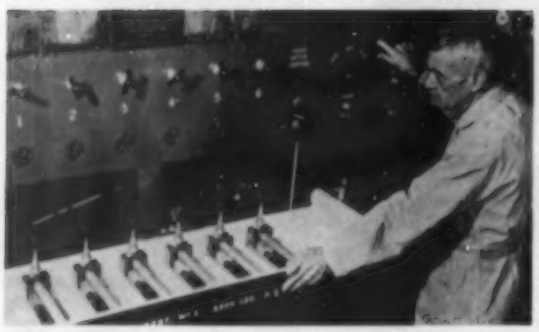
The cylinder, with a three inch stroke, raises a steel plate on which several rows of wheels have been mounted. At the top of the stroke, the box is completely free of the roller conveyor on which it had been moving and it rests on the rows of wheels which protrude between rollers.

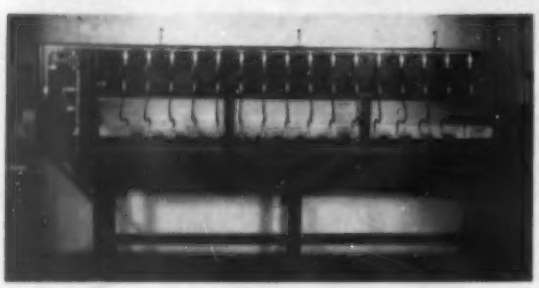
At this point, the rising wheel mounted plate presses against another air valve, this one mounted under the roller conveyor. Air pressure now acts on a piston which pushes against the side of the box, moving it onto a wide roller storage conveyor.

The ingenious arrangement of air pistons, rollers and wheels carries a box around a right angle turn and, at the same time, changes box movement from lengthwise to sideways. As a result of side-by-side storage, capacity of the storage conveyor has been greatly increased.



HIGH PRESSURE TESTING
of air and oil cylinders





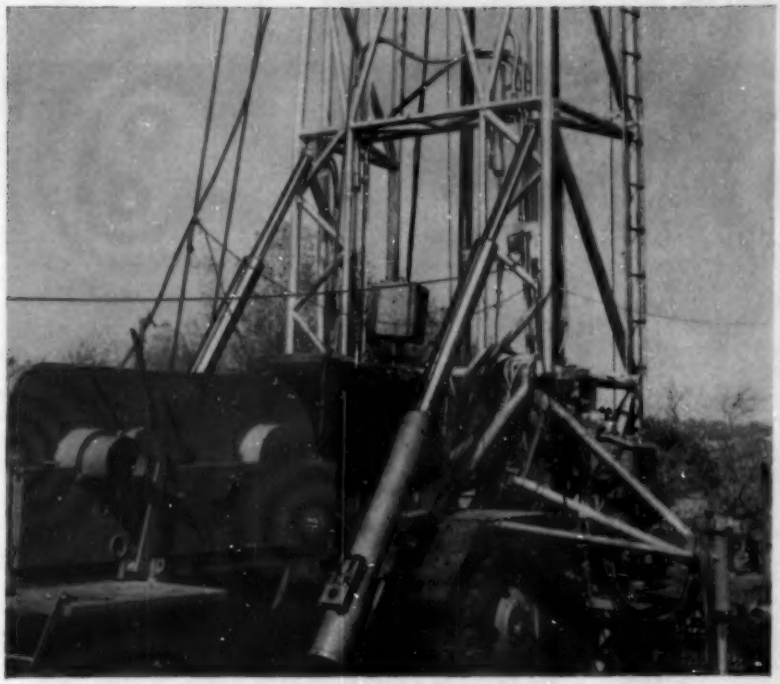
HIGH pressure testing has always presented problems to manufacturers. This type of testing equipment nearly always involves high cost, consumes large areas of factory space, and in many cases is not as efficient and safe as required.

The Herman Machine & Tool Company, Tallmadge, Ohio, was faced with the problem of setting up test equipment for small diameter pneumatic cylinders. The high cost and extended delivery of high pressure equipment made them realize that something had to be developed in their own plant. Their engineering department designed and built special testing equipment which combines simplicity and effectiveness with low cost of operation and minimum of maintenance.

The test equipment consists of a suitable steel stand having a plexiglass covered inclosure in which the cylinders are placed for pressure and leakage tests. Each cylinder is individually connected with a supply of nitrogen gas through valves and gauges in a manner that permits the removal, or replacement, of any one cylinder at any time. It is of great advantage that each cylinder is connected separately and may be removed, or installed, at any time during the test without disturbing the test procedure of the rest of the cylinders mounted on the same test stand.

The high pressure phase of the problem was solved in a simple, safe and efficient manner by inter-connecting nitrogen gas with a closed hydraulic system. A control system, actuated by solenoid valves and mercury switches, returns the oil to storage and delivery tanks for use in the next compression cycle. This method eliminates refilling and waste, and simplifies the operation and maintenance of the system. All testing operations can be conducted by one person.

The cylinders are placed in the test stand, pre-set and locked into place by a comparatively low pressure. The operator makes sure that all cylinders are properly seated, then applies the high pressure. The high pressure leakage test is performed by subjecting the cylinders, after they are mounted in the test stand, to a pressure of 3200 psi for five minutes. If leakage is present in this test, the cylinder is immediately removed from the test stand, and the cause of leakage determined and corrected. After the cylinders have passed the short duration high pressure test, they are placed in a similar rack and subjected to a pressure of 1600 psi for a period of four hours. The pressure must not, under requirements of the contract, exceed 25 psi drop during the four-hour test period.



How 35 Tons of Controlled Effort Positions the boom of this drilling rig . . .

For the smooth, fast, and safe erection of the boom of the Franks rotary drilling rig, two "Commercial" two-sleeve telescopic cylinders with 117" stroke work in parallel. Each develops an initial thrust of over 35,000 pounds on the push stroke when operating under oil hydraulic pressure of 1000 psi. To provide the positive initial force required to move the boom off its vertical dead center toward its horizontal traveling rests, the second sleeve of each cylinder is built with a double-acting feature which develops a thrust of over 19,500 pounds on the pull stroke.

Only telescopic cylinders provide a means of obtaining long stroke and yet occupy relative small space when in closed position. Here is another good application of this principle.—distance pineye to pineye in closed position 74", extended 191". "Commercial" is the largest manufacturer of 2, 3, 4 or 5 sleeve telescopic cylinders, all designed for operating at pressures up to 1500 psi. They are available in single-acting type having capacities up to 25 tons on the push stroke and in double-acting type having, in addition, capacities up to 15 tons on the pull stroke.

"Commercial" has been producing heavy-duty oil-hydraulic controls for over 25 years—pumps, motors, valves, and cylinders—all dependable and built to give trouble-free operation. You will do better to place all your oil-hydraulic problems with one producer. Consult with a "Commercial" engineer.

"COMMERCIAL"
"PRODUCTS PREFERRED BY CUSTOMER ACCEPTANCE"

THE COMMERCIAL SHEARING AND STAMPING COMPANY
Youngstown, Ohio Chicago, Illinois Salt Lake City, Utah

PUMPS · MOTORS · CYLINDERS · VALVES

KA-53

Oil-hydraulic is the fluid power that gives positive, sensitive, and controlled action; and oil-hydraulic controls occupy less space, provide cleaner installations, have fewer moving parts, and go a long way in reducing costs.

It's getting hard to find a piece of heavy-duty construction equipment today that does not utilize the advantages of oil-hydraulic controls.

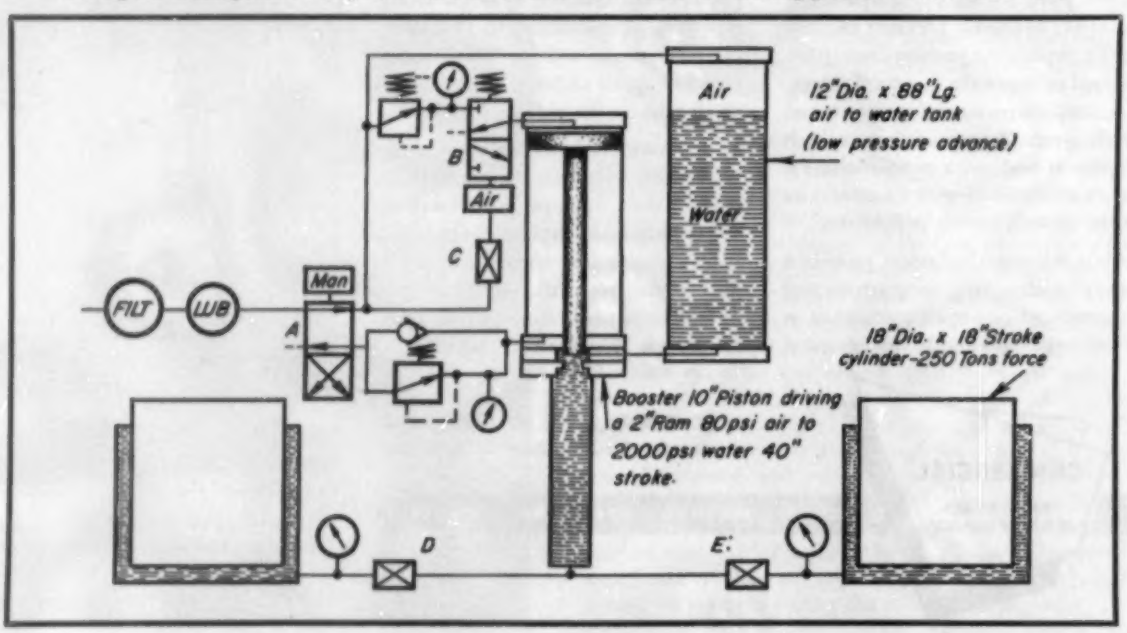
Press Revamp Uses Air-Water Booster

WHEN the Metro Rubber Products Corp. Justice, Ill., wanted to obtain greater production versatility from their molding presses, they decided to operate two of the presses independently of their centralized pumping system. For a power source they selected an air-water booster arrangement which is simple, economical, versatile, and can provide an insurance margin for existing production facilities in the event of a breakdown in the main central power system.

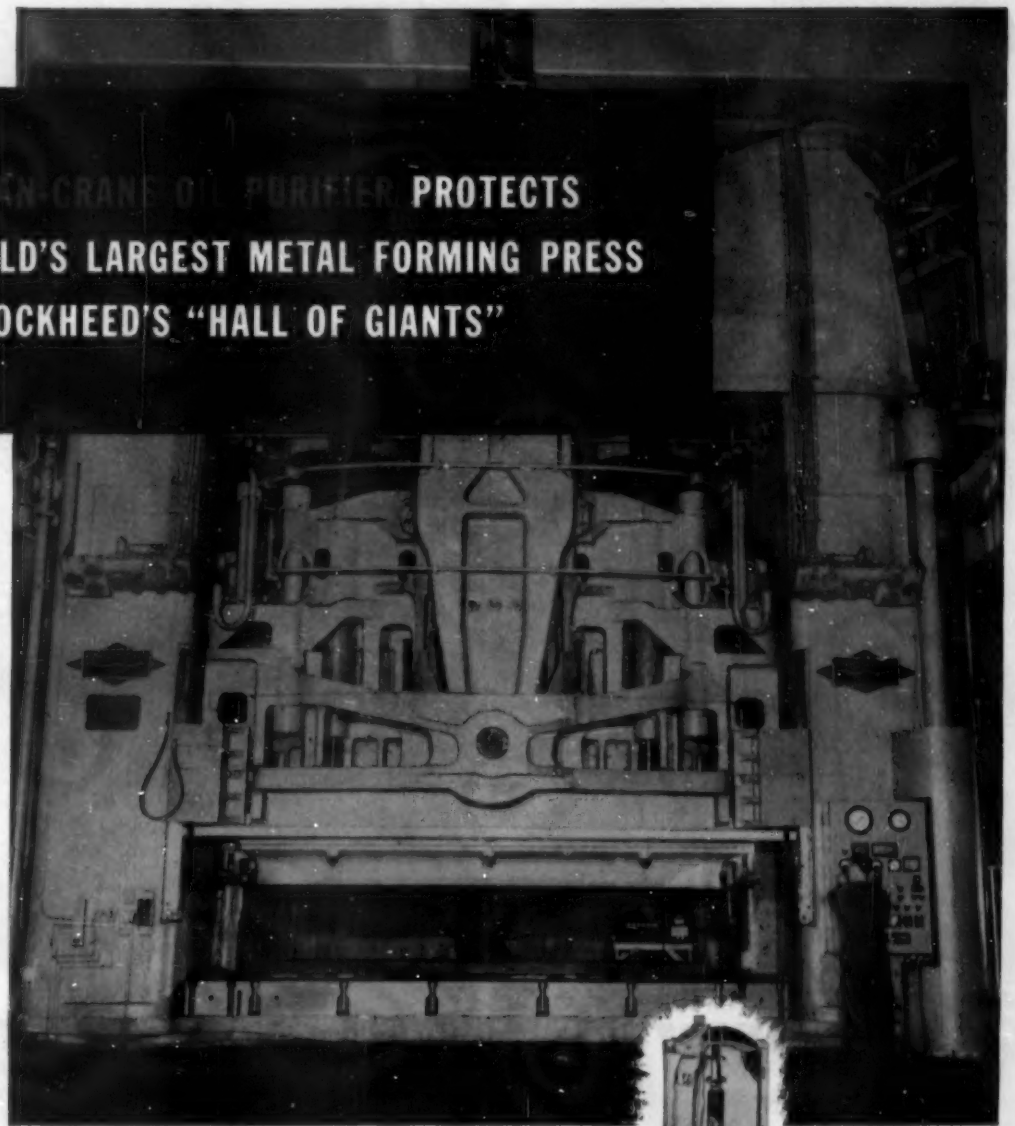
The press platens are 24 in. by 24 in. The press cylinders are each 18 in diameter with an 18 in. stroke. There are three platens on each press. The platens will accommodate two large molds. The molds vary from one cavity to 196 cavities each, and form items ranging from small caps to large vibration dampeners. The photograph shows electrical outlet covers from the 40 cavity molds in the press at the left.

For this installation a 12 in. diameter air-water tank 88 in. long supplies fluid for the advance stoke of both working cylinders. With a 25 to 1 booster, 80 psi air input produces 2,000 psi water output for the high pressure required. The booster has a 10 in. air piston driving a 2 in. hydraulic ram through a 40 in. working stroke to give approximately 125 cubic inches of high pressure water.

BOOSTER ARRANGEMENT can be used to drive one press cylinder or both without incurring power loss during the holding time. Two psi air will return the booster ram to the starting position in this installation.



HONAN-CRANE OIL PURIFIER PROTECTS WORLD'S LARGEST METAL FORMING PRESS IN LOCKHEED'S "HALL OF GIANTS"



Honan-Crane Bulk Refill Purifier No. 21300 with built-in pump and motor services Birdsboro press pictured. Purifier operates 20 feet below floor level. This model is capable of servicing a 2,000-gallon system.

● Aircraft sections up to 10 by 30 feet are formed from ½" aluminum sheets on this Birdsboro hydro press. Its overall height is 51 feet and its weight a staggering 2,750,000 pounds. Because clean hydraulic oil is a vitally important factor in the operation of this mammoth press, Lockheed gives it the safe, dependable protection of a Honan-Crane Oil Purifier.

You'll find Honan-Crane Purifiers in America's finest plants . . . protecting equipment of all kinds and sizes from the wear and damage caused by oil contamination.

Give your plant the benefit of Honan-Crane's 30 years' filtration experience. There's a Honan-Crane Purifier for complete removal of either solid or soluble contaminants from hydraulic, lubricating, insulating and other oils. Sales engineers in principal cities are at your service. Write for engineering bulletins covering your specific problem.

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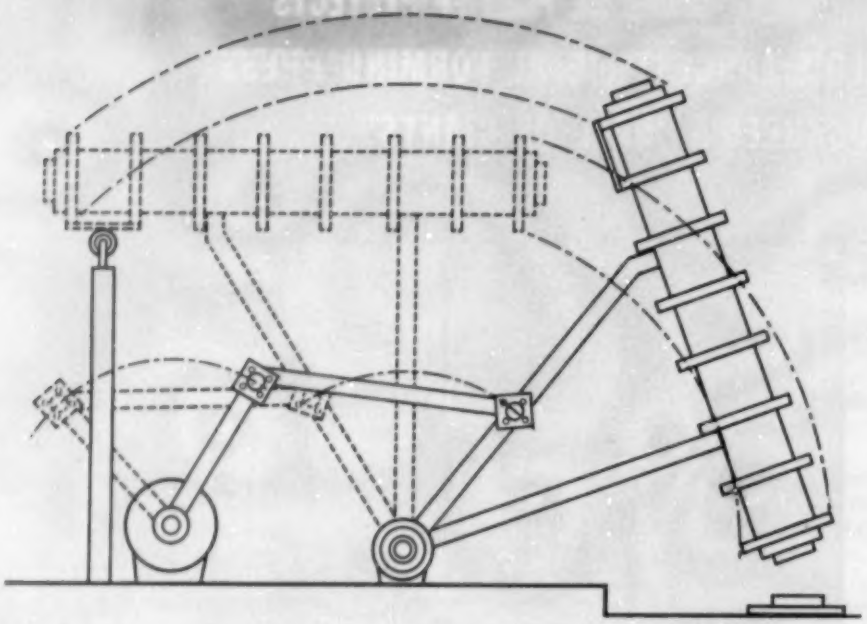
How would you power this motion?



Oil Powered Rotary Actuator Solves A Positioning Problem

MANAGEMENT of the Concrete Conduit Company, in Queens, New York, had a work positioning problem which has been solved by the mechanism shown in the drawing. For a power source, they chose a hydraulic rotary actuator. They estimate that this simple, inexpensive installation will save up to $10,000 a year.

Each section of concrete conduit which the company produces, measures 4 inches square by 4 feet long and weighs approximately 225 pounds. The conduit and form together weigh 350 pounds. There are four operations in the manufacturing process of the product. The vertical form for the conduit is supported on a four position rotary table. The first step in production, is the pouring of the concrete into the molds. No actual work is done during the next two stations of the table. These idle positions allow sufficient time for the concrete to set. When the conduit and form are unloaded from the rotary table and placed on the horizontal rack, all stages of production have then been completed.

One Man Does the Job

Previously, three men manually unloaded this heavy, bulky form from the rotary table. Now, one operator and the hydraulic actuator installation do this job, efficiently and inexpensively. Figure 1 shows the hydraulic circuit used in this installation. Speed

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Other features: for pressures from 35 to 200 p.s.i. pneumatics, hydraulics, vacuum; complete line—2-way, 3-way, 4-way and 4-way-5-port (2-pressure) models; foot or sub-base (manifold) mounting; pipe sizes —¼", ⅜", ½", ¾", and 1".

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. . . for this motion a linear cylinder would require a rack and pinion; an electrical drive would be impractical

control valves prevent the load from "running away" when the center of gravity shifts from one side to the other of the point of rotation.

The hydraulic rotary actuator is a compact unit. It consists of a cylindrical body enclosed at both ends. Integral with the shaft is a vane which is close fitted to the inside surfaces of the chamber and rotates in either direction as the pressure is applied. A stationary partition divides the cylinder into two compartments, which permits the introduction of oil to either side of the vane. The pressure of the oil action on alternate faces of the vane produces reciprocating rotary motion (and torque) of the extended shaft.

Low Maintenance Cost

The motion supplied by the actuator is ideal for powering this type of linkage which requires much less than the maximum 280 degrees of rotary reciprocating power available from the actuator. Use of a linear reciprocating cylinder would have required a rack and pinion. Direct electrical drive would be impractical for this motion.

The first rotary actuator was installed by Concrete Conduit company about a year ago. Two duplicate additional units have since been put into service. There have been no maintenance costs other than the normal change of hydraulic oil.

Use of the hydraulically powered device has freed two men from each machine for other duties within the plant. The management has computed their savings, in direct labor alone, as $10,000 per machine per year. What makes this amount of savings so outstanding, is that the total cost for equipping each machine was under $2,000. This means each installation pays for itself in only two months.

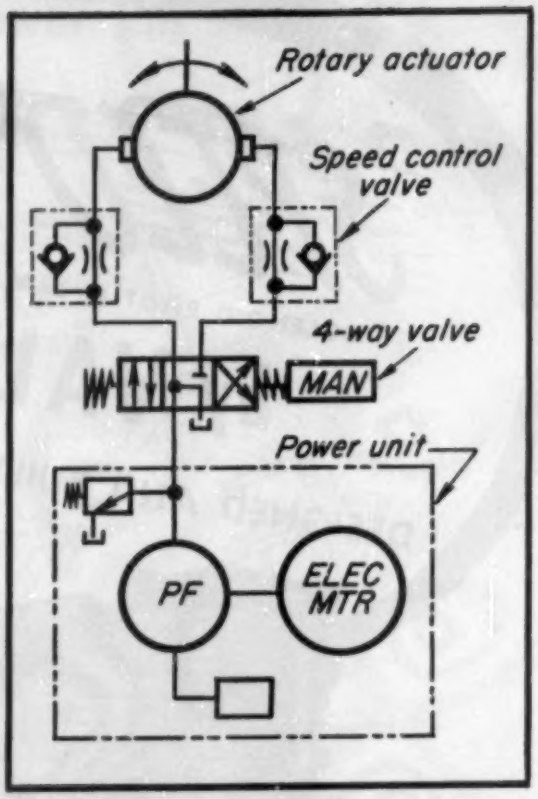

FIG. 1. A MANUALLY controlled hydraulic circuit supplies rotary reciprocating motion to the output shaft.

Data for this article was supplied by The Airoyal Company, New York City.

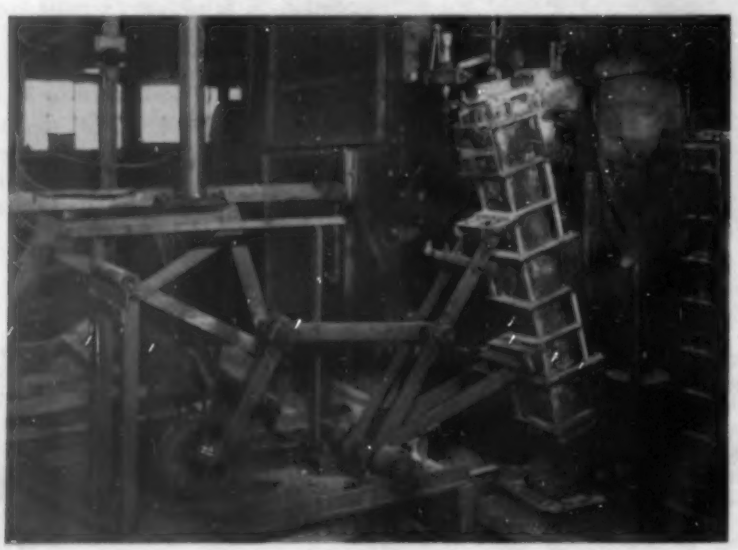

FIG. 2. THE VERTICAL 350 pound form is being moved from the work table to be placed on a horizontal platform.

It has to be good

When it can't be readily serviced—that's another WATERMAN FLOW REGULATOR Story.

Yale & Towne, one of the leading manufacturers of material handling equipment use WATERMAN FLOW REGULATORS as standard equipment on all their fork trucks. This is not unusual, since WATERMAN supplies the majority of flow regulators used for lift trucks, but the position of the regulator demonstrates the confidence Yale & Towne have placed in WATERMAN equipment. The flow regulator is installed inside the lift cylinder. This means that the flow regulator is not readily accessible for servicing. No flow regulators or any other hydraulic equipment would be installed in such a position if it did not give years of trouble free service.

A 6,000 lb. Yale Gas Fork-Lift truck in operation.

Wherever constant flow or fluid is required regardless of pressure or back pressure fluctuations, WATERMAN FLOW REGULATORS are the answer. More and more manufacturers incorporating hydraulic equipment in their products are finding the WATERMAN FLOW REGULATORS simplify circuits, reduce weight, space and cost while providing automatic flow regulation. Available in a range of sizes and a variety of models.

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Brake Design for Jet Aircraft

. . . gives split-second response

By Joseph N. Steinmetz, Jr.

A BRAKING system presently in operation on one of the nation's jet interceptors employs a principle of low fluid displacement in the slave line from the master cylinder to the brake relay valve in order to provide fast response of the braking action. Experience with some aircraft power braking systems in the past has indicated that the response has left much to be desired, especially under cold weather operating conditions.

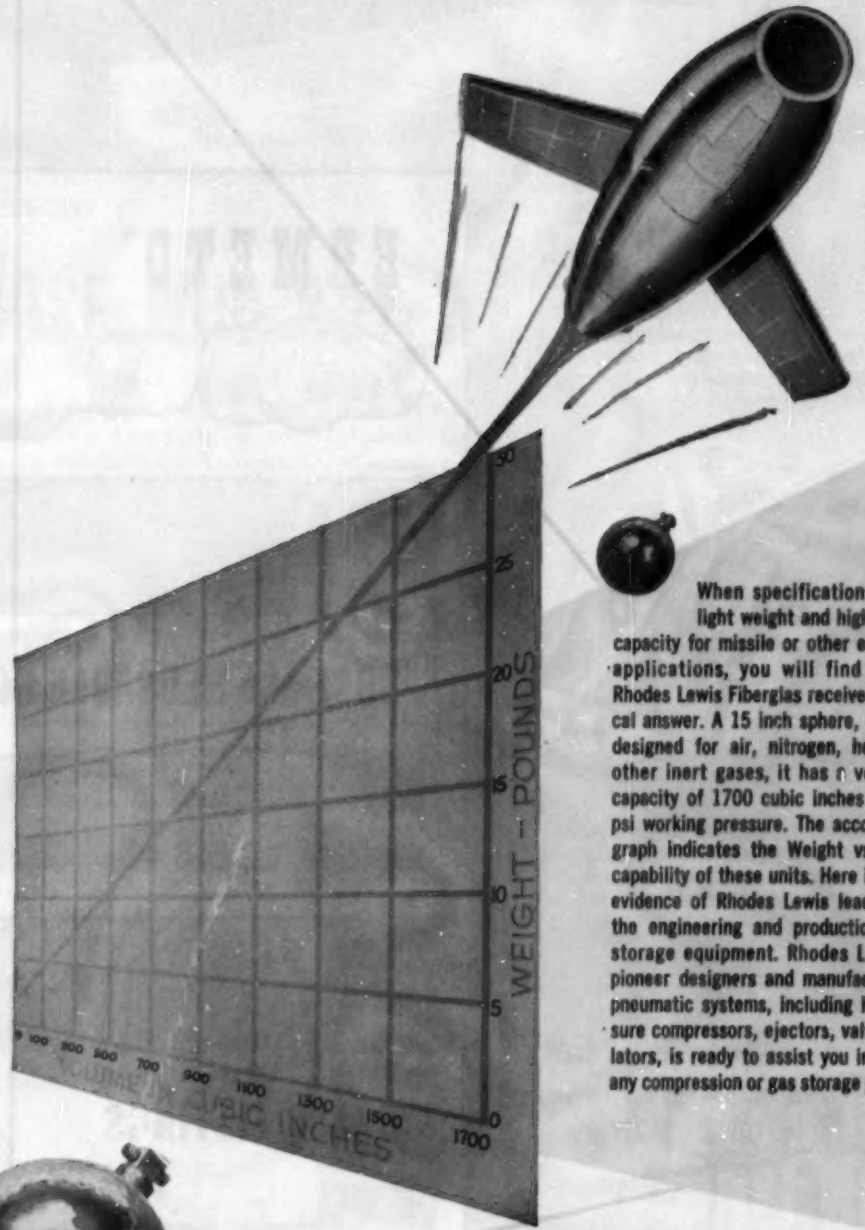
The difficulty arises when the pilot depresses the brake pedal to decelerate the ship. If the pilot does not get split-second response he tends to over-depress the pedal, so that when the pressure does develop he momentarily gets more than the desired amount of braking. The pilot will then search for the corrected pedal position, but the action can be erratic enough to cause swerving, skidding and poor control of the ship.

The system of Figure 1 consists of a brake master cylinder which is mechanically connected to the brake pedal, and a brake relay valve which is essentially a hydraulic pressure operated pneumatic regulator, as distinguished from coil spring operated types. The relay valve is located on the main landing gear strut, and received hydraulic pressure from the master cylinder by means of a 3/16 tube size steel line. The total system is illustrated by Figure 1.

The application of 2½ degrees of brake pedal

JOSEPH N. STEINMETZ, JR., Hydraulic Group Consolidated-Vultee Aircraft Corporation, San Diego, Calif.

WEIGHT COUNTS



When specifications call for light weight and high pressure capacity for missile or other expendable applications, you will find the new Rhodes Lewis Fiberglas receiver the logical answer. A 15 inch sphere, especially designed for air, nitrogen, helium and other inert gases, it has a volumetric capacity of 1700 cubic inches for 3000 psi working pressure. The accompanying graph indicates the Weight vs. Volume capability of these units. Here is striking evidence of Rhodes Lewis leadership in the engineering and production of gas storage equipment. Rhodes Lewis Co., pioneer designers and manufacturers of pneumatic systems, including high pressure compressors, ejectors, valves, regulators, is ready to assist you in meeting any compression or gas storage problems.

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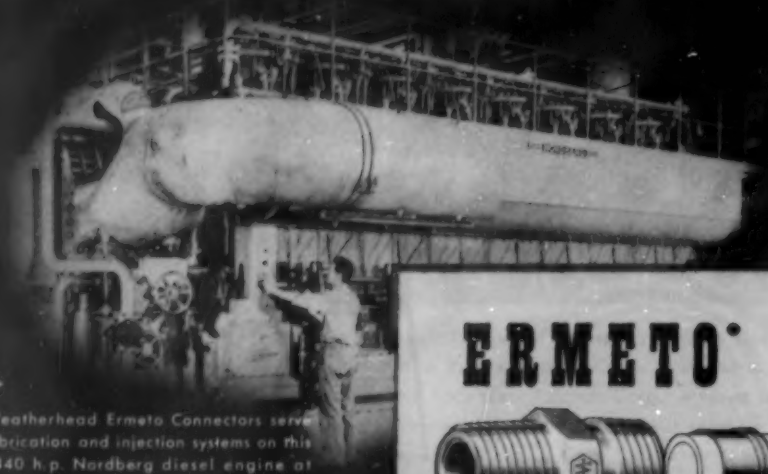

Weatherhead Ermeto Connectors serve lubrication and injection systems on this 3440 h.p. Nordberg diesel engine at working pressures up to 9000 psi.

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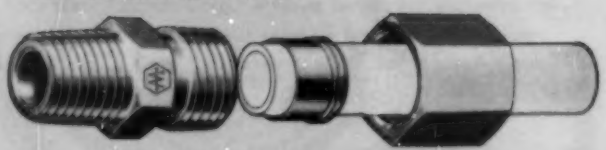
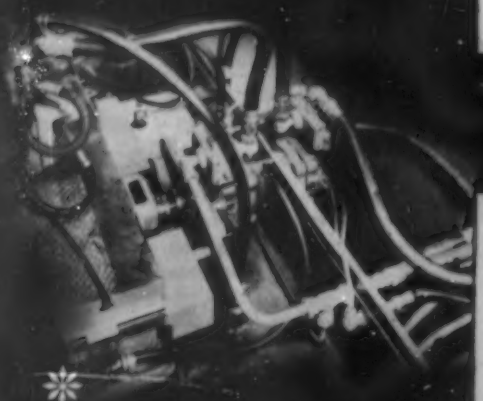
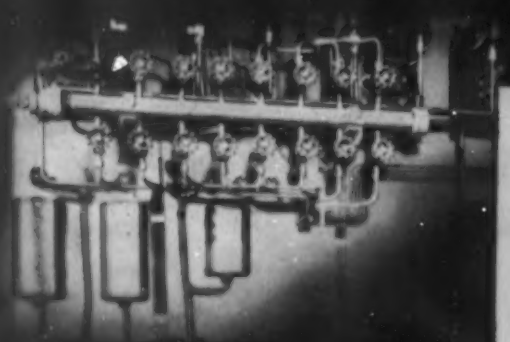




Weatherhead hose and coupling assemblies link this Van Norman grinder to its Vickers power unit. Replacements are readily made from stocks of bulk hose and matching couplings.

HOSE AND REUSABLE COUPLINGS



Weatherhead Brass Fittings connect air lines in the Cleveland Electric Illuminating Company's Lakeshore Steam Power Station, Cleveland, Ohio.

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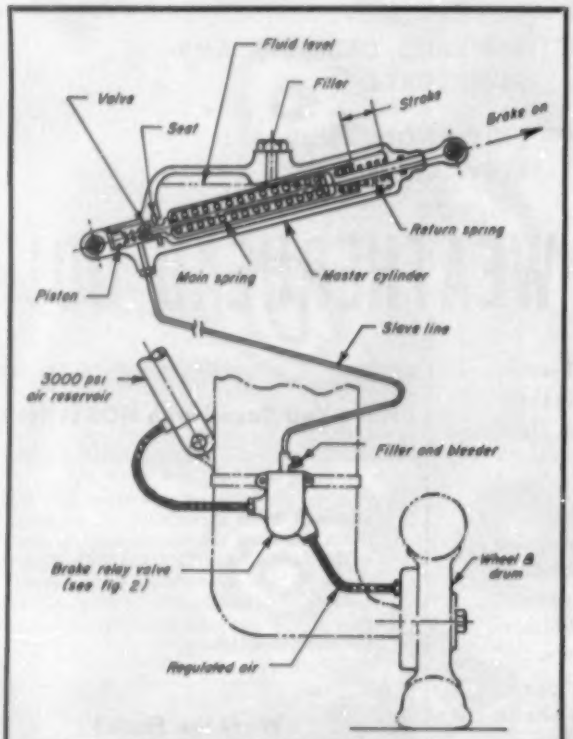


Fig. 1. Schematic of brake system.

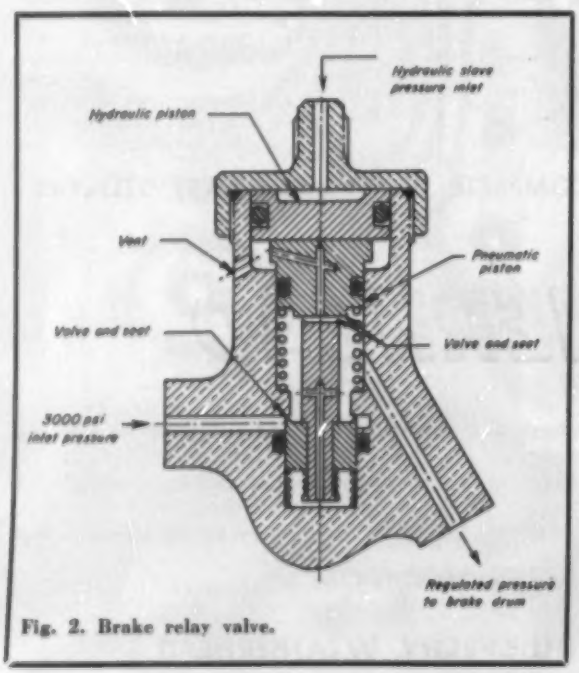


Fig. 2. Brake relay valve.

travel is sufficient to close the valve in the master cylinder, thus trapping a quantity of oil ahead of the brake cylinder piston. Further travel then continues to compress the master cylinder main spring. The spring is mechanically and directly connected to the piston, so that an increasing spring force produces

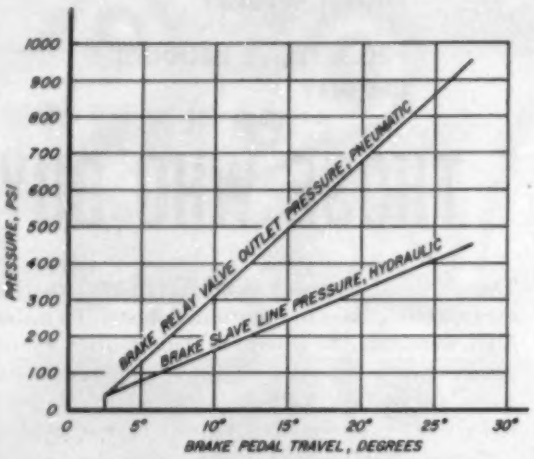


Fig. 3. Relationship of air and hydraulic pressures.

an increasing hydraulic pressure. The flow of hydraulic fluid involved in the transmission of hydraulic pressure is practically zero. This means that there is practically no line loss or time required for the necessary flow to occur before the pressure can build up, which accounts for the fast response of the brakes. The pressure can be transmitted without any movement of the piston, except as required to make up for the slight amount of compressibility of the oil, expansion of the lines, and possible compression of entrapped air. The 3/16 tube size steel line proves more satisfactory than a ¼ inch size because of the reduction in compressibility and expansion factors.

It is important to bleed the slave line completely of air in order to insure a solid column of fluid. It has been found necessary to bleed the air out of the slave line by connecting into a bleed fitting near the relay valve with a hydraulic test stand. A flow of 1 to 2 gpm is then circulated through the slave line and out through the master cylinder filler port until all of the air bubbles are eliminated. The brakes are exercised during this bleed procedure. A hydraulic hand pump or gravity fill have been found to be unsatisfactory.

Upon application of the brakes, the increase in hydraulic pressure and the corresponding increase in pneumatic pressure are shown by Figure 3.

The pneumatic pressure to the brakes is released through an integral vent in the relay valve whenever hydraulic pressure reduces. The relay valve is shown by Figure 2. The greater area of the hydraulic piston as compared with the pneumatic piston produces the desired multiplication of the pressure as required for proper application of the brakes.

Each of the main wheels has a separate and com-

pletely independent braking system for safety. The separate systems improve the safeness because under most landing field conditions the aircraft can be brought to a safe stop with one wheel brake alone, with proper application also of the rudder and the nose wheel steering.

The brake relay valves have been mounted directly on the landing gear struts adjacent to both the air reservoirs and the wheels. This provides short pneumatic lines, which, when combined with the small slave line and the efficiency of the units, results in a low total weight value.

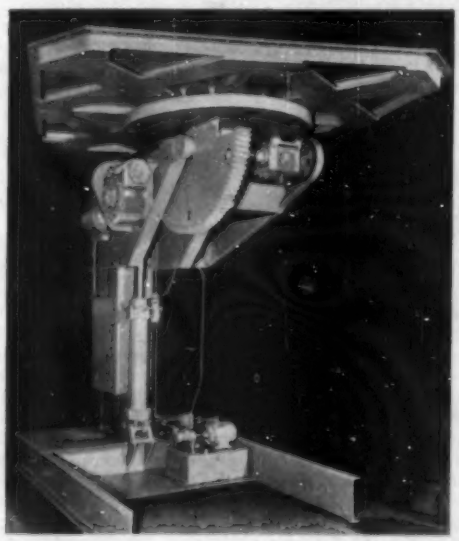
Positioning Heavy Weldments

THE major problems confronting manufacturers of weldment positioners, especially under heavy loads, are:

1. Where to absorb the large torques that are developed.
2. How to efficiently prevent "drifting" of the positioner table under these heavy loads.
3. Positioning the load smoothly, continuously and accurately.

Pandjiris Weldment Company, St. Louis, answered these problems simply and economically by using double-enveloping worm gear speed reducers for rotary and tilting motions and a hydraulic system for raising and lowering.

Typical of their complete line of welding positioners is the 40,000 pound unit illustrated. The three-way movement of the positioner table locates work for down-



position welding. Any load placed on the positioner table is absorbed as torque at the output shaft of the speed reducers. A 70:1, 10 inch center distance standard speed reducer, which must absorb torques up to 150,000 inch-pounds, drives the tilting system. Another 70:1, 7 inch center distance reducer which must absorb torques up to 52,000 inch-pounds, drives the rotating system. The table may be tilted in arc of 135 degrees and rotated a full 360 degrees. It can be elevated vertically up to four feet through the built-in hydraulic lift system.

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REPRESENTATIVES of air lines, aircraft builders and component suppliers met in St. Louis for the spring meetings of the SAE Aircraft Committees

An Applied Hydraulics Magazine Report . . .

SAE Aircraft Meetings

SAE Committee A-6, Aircraft Hydraulic and Pneumatic Equipment held their regular spring meeting at the Chase Hotel, St. Louis, April 28, 29 and 30. Chairman B. R. Teree presided over the sessions which were attended by over 200 representatives of the airframe and air line industries, vendors of components, materials and supplies and the Services.

On Thursday morning, the 29th, Fred Hosterman, Chairman of the Sub-committee on Hydraulic System Materials, took over the meeting for items on fluids and packings.

Non-Flammable Fluids

WADC reported that no progress had been made with MIL-F-7100 since the last meeting. A BuAer representative also reported no change but that hydrolube was still in use in some planes. No new data was reported on OS-40 (Skydrol 500). Precision Rubber Products reported that the proposed spec on butyl packings for Skydrol type fluids had been forwarded to AMS.

High Temperature Hydraulic Systems

This item developed considerable discussion. Reports by both Services developed the following, based on their conference with airframe manufacturers on January 26 and 27,: (1) that operating temperatures are not as high as some believed previously; (2) very little test data is as yet available; (3) a flight test form has been prepared to aid collection of data; (4) Services are integrating data as a guide for progress in high temperature work. The same Service-Industry conference set up 275 F as the maximum fluid temperature for MIL-F-5606. The silicate-ester high temperature fluid MLO-8200 was nominated as the most promising fluid for −65 to 400 F operation. However, experience is insufficient for a decision and the project was recommended for an additional year's study. In addition OS-45-1 shows considerable promise. This and other fluids will be studied. WADC has awarded Douglas, Santa Monica, a contract to test various packings with MIL-F-5606 at higher temperatures. BuAer was asked to detail how equipment people would go about high temperature qualification. This will be covered in a proposed spec revision. BuAer did suggest that since components submitted for 160 F limits were endurance tested at 100 F and that they would use the same proportion for 275 F test qualification. The Republic Aviation member outlined the need of part cycling test runs, 0 to 275 F, as a realistic approach to high temperature progress. BuAer agreed, and suggested 10-25 percent of endurance cycles at 275 F.

Republic asked for a new AN number for 275 F "O" rings; WADC stated that a new MS drawing would be made. The chairman read a memo regarding a recent action of NASC in setting up standards for High temperature "O" rings and identification. The Chance Vought member pointed out that the alternate to quick action on a new AN number would be a company standard. WADC stated that spec for high temperature packing materials and new MS drawings could be available in 30 days.

High Temperature Cycling Tests

The North American, Downey, representative added detailed data covered at the Service-Industry conference on the hydrolitic stability test (WADC), in which water was added to the test system and pumped through the filter. MLO-8200, with ½ percent water by volume added, clogged the high pressure filter in 25 hours, both filters in 49 hours. With OS-45-1, and 2 percent distilled water added, a paper filter element clogged in 7 hours. At North American, ½ percent of water by volume, operated in a 50 cc transparent accumulator, clogged a 3000 psi relief valve in 17 hours of operation. WADC is setting up tests, no water added, for 400 F operation. The chairman suggested that the AF continue the MLO-8200 tests and MuAer tests on OS-45-1.

High Temperature Boss Seal

WADC summarized the high temperature hydraulic and pneumatic program. It was suggested to the Services that an interim short life fluid for 30 to 700 F operation be setup. North American, Downey, asked for information on fortifying MLO-8200 for temperature compatability. With specific neoprene, North American got good performance with OS-45-1 up to 550 F; some packings with MLO-8200 plasticizers leeched out. BuAer promised a new spec in 60 days.

MIL-P-5516 Packings and Gaskets

WADC described a spiral failure fix-drill hole in strut, direct MIL-L-4343 to "O" ring. No reports as yet indicate if failures were reduced. Lockheed member reported grease was not successful in preventing failures. North American reported that using a self-displacing accumulator with aluminum barrel and chrome plated piston rod and atmospheric conditions on one side, they got consistent failures by increasing the temperature to 160 F. Numerous fixes were unsuccessful. After 50,000 cycles, equally divided between long and short strokes, the "O" ring looked like new.

Lockheed tested the quad ring, reported no failures; better results were obtained with a bronze adaptor but with a weight penalty of 6 or 7 pounds. BuAer is satisfied with the delta rings.

Additional Size "O" Rings

A survey reported at the last meeting disclosed a need for larger size AN6230 rings, removed several years ago, and for smaller rings in the present diameter. WADC is conducting tests on AN6230 rings (cold box for shrinkage); no action will be taken until the tests are complete and reported. MS drawings have been prepared to cover addition of small sizes in the AN6227 series.

"O" Ring Size Designations

The Precision Rubber Products representative, reporting for a special panel, outlined a uniform system designating "O" ring sizes by spec dash number (method MS29513). The Adel member pointed out that the system would result in much confusion. The committee decided to use new drawings. The chairman asked for this system for high temperature rings.

Backup Rings

The chairman pointed out that new MS drawings did not include some changes suggested by a survey reported last meeting by the North American member. The chairman asked for the changes to be made and to forward the survey to the Services. The Boeing member pointed out two installation difficulties: (1) the backup ring as a static seal doubled itself back when the cap is screwed on the cylinder; and (2) when used as a piston seal, the end of the backup ring wrapped up over the "O" ring. Similar trouble was reported by other airframe manufacturers. Douglas, El Segundo, reduced such trouble by modifying entry chamfer (30 degree angle, minimum ring .052); Lockheed follows

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SAE Aircraft Meetings

the same procedure but prefers a solid ring. Action was deferred until more experience has been reported.

MIL-P-5514 Packings; Installation and Gland Design of Aircraft—Hydraulic and Pneumatic

The United Airlines member had previously reported (1) corrosion from felt wipers AN6232 on hydraulic cylinders due to their affinity for moisture; and (2) corrosion caused by scraper ring AN6231, due to dissimilar metals. After considerable discussion, the Republic Aviation member was requested to prepare a spec on the use of wipers and scraper rings to submit to the committee's next meeting.

This item completed the group of items chairmanned by Fred Hosterman. Bob Teree, A-6 Chairman, resumed the gavel for the remainder of the sessions.

Pressure Transmitters and Gages

WADC reported on work being done on a direct reading capillary tube type gage. The Instrument Laboratory is running vibration and impulse tests, as yet uncomplete. It is apparent that shock mountings for all pressure gages, not a part of the original test program, must be considered and reported when the program is completed. The airframe and airline members unanimously recommended that the services attempt the development of more finely graduated standard gages for aircraft hydraulic systems.

Hydraulic Components; General Specifications

The North American member had proposed a change in one paragraph which incorporated requirements on the method of designating rate or quantity of flow calibration in part numbers. The changes were discussed, coordinated with aircraft members and are being forwarded to the SAE office for transmittal to the Services.

Hydraulic Tubing

The ASG representative reported on a meeting of the Council for Military Aircraft Standards (CMAS) in April where an effort was made to establish minimum bend radii. BuAer presented their data which had gone into the CMAS compilation. This data is now being coordinated with the AF. A Northrup representative reported considerable difficulty with AMS 5566 tubing when fabricated due to leakage at the flares. Douglas, El Segundo, reported that rough, pickled tubing was tested to determine a comparison with smooth tubing. The pickled tubing had lower impulse life. The number of suppliers was cut to two, inspection procedures tightened up; no further flaring troubles were experienced. The chairman suggested the airframe companies put this problem up to their tubing suppliers.

Titanium Tubing and Fittings

The Boeing representative reported on results of impulse and vibration testing conducted for the Navy on Ti-75A tubing. Surface roughness inside made it necessary to ream before flaring. Same tests were conducted on Ti MS flareless fittings, Steel AN fittings, steel MS fittings and titanium AN fittings. Weatherhead reported the same texts of pure titanium fittings on 61ST tubing as satisfactory; over tightening torques as very good, especially flareless.

MIL-A-5498 Accumulators, Aircraft Hydraulic Pressure

A BuAer representative stated that this spec was being modified to comply with a recommendation of the committee to increase air and leakage rates. The chairman asked the Republic member to determine by survey if the airframe industry wants a separate spec on a return type self-displacing accumulator. The Douglas

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SAE Aircraft Committees will hold fall meetings at the Hollywood Roosevelt Hotel, Hollywood, Calif.; A-3 on October 11, A-6C on October 12 and A-6 on October 13, 14 and 15.

El Segundo member reported from a survey that the airframe industry definitely favors two classes of accumulators: shatterable and nonshatterable. WADC stated that they had referred this problem to the Aero Medical Laboratory, and reported their comments: (1) weight and cost savings of the shatterable reservoir is small compared to the additional hazards; (2) tests to date indicate that there is no safe location for shatterable reservoirs on aircraft; (3) units should not shatter and should resist tears greater than 3 in. in length; and (4) costs of gunfire tests are small enough to make dropping of tests of little value. BuAer stated that since this is a military problem it would be referred to military operations people for a decision.

MIL-R-5520A Hydraulic Reservoirs

WADC reported a number of difficulties—water freezing at bottoms of hydraulic reservoirs or in dead end drain lines. There have been cases where lines have burst and hydraulic fluid lost. Lockheed uses a stand-pipe in reservoirs to prevent water entering into lines. The Services consider this a minor problem. No committee action. Most airframe representatives believe that the 150 percent factor of displacement is excessive. The Services are to review the spec.

MIL-H-5440 Hydraulic Systems, Design, Installation and Tests of Aircraft

Both the Services are working on revisions of this spec; the most important of which is the change in upper temperature limit from 160 F to 275 F. The AF asked for suggestions and comments from the airframe industry on procedures and equipment for filling airless reservoir type systems. The chairman asked the Services to continue this study.

MIL-R-8573 (Aer) Specification, Reservoirs, Air-Non-Shatterable

A WADC spokesman reported that this spec was being coordinated and would be ready in approximately one month. The Aero Medical Laboratory is coordinating this spec with carbondioxide and oxygen cylinders.

MIL-P-8564 (ASG) Specification, Pneumatic Components

The Chance Vought member reported on a survey on revisions suggested to this spec. A number of changes were discussed and agreed

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upon. Some of the most important were: (1) use of standard units whenever possible; (2) acceptance of a humidity test as the basis of an accelerated test program; (3) agreement to eliminate snap rings; the question of separate solenoids was left to a sub-committee; (4) the detail requirement of dryness of air for routine production testing, being determined as difficult, was returned to the sponsor to survey: (5) The Services asked for 100 percent inspection testing of pneumatic components.

MIL-P-5518, Pneumatic Systems, Design, Installation and Tests in Aircraft

The Cornelius Company representative reviewed the operation, testing and inspection problems involved. The Republic Aviation member reported on a survey of a proposed second revision (Revision B) with action as follows: (1) to include 5000 psi systems; (2) Coatings specified in MIL-C-5541 are not acceptable where they may cause abrasion; (3) the ground charging problem (air not dry) is no longer serious as the Services are acquiring adequate moisture removal equipment; and (4) no change was considered necessary in Table 11 showing proof and burst pressures of air bottles.

MIL-R-8572 (Aer) Specification, Pneumatic Pressure Reducer

The Pneumatic Sub-committee chairman reported on a meeting held in February at Washington to coordinate this spec. This has been turned over to BuAer who will coordinate with the AF.

New Pneumatic Specifications

Representatives of BuAer and National Bureau of Standards reported that the solenoid valve spec was ready and that the self-sealing quick disconnect coupling was in preparation. A draft of an overall report would be made within a month to the chairman of the Pneumatic Sub-committee for distribution.

High Temperature Operating Requirements of Pneumatic Components

The Glenn L. Martin member stated that the data collected to date was principaliy for hydraulic pumps but of interest to manufacturers of pneumatic components. The Lockheed member pointed out that tests at consistent high temperature (400 F) were far less severe on "O" rings than temperature cycling. In tests "O" rings deteriorated badly after 50,000 cycles. The Douglas (El Segundo) member pointed out that the Douglas seal showed some promise for low temperature operation (inclined groove and teflon back up rings).

MIL-G-4343 Lubricating Grease, Pneumatic,

This grease exhibited a definite tendency to breakdown at high temperatures. There was no agreement as to the temperature of breakdown. WADC reported breakdown at approximately 400 F. The Cornelius member reported the grease (QPL) can be broken down at 250 F in an oven test. Another grease to the spec (not QPL) breaks down at 250 F and tends to form sand-like particles at high temperature.

SAE A-3 Meeting

Committee A-3, Aircraft Fittings and Flexible Hose Assemblies, met for two days, April 26 and 27. L. J. Henderson, acting chairman, presided over one of the largest groups ever to attend a meeting of this committee.

AN 927, 938, 939 and 941 Fittings

The Weatherhead Company reported on tests run on this series of fittings. Two definite recommendations were made: to machine a

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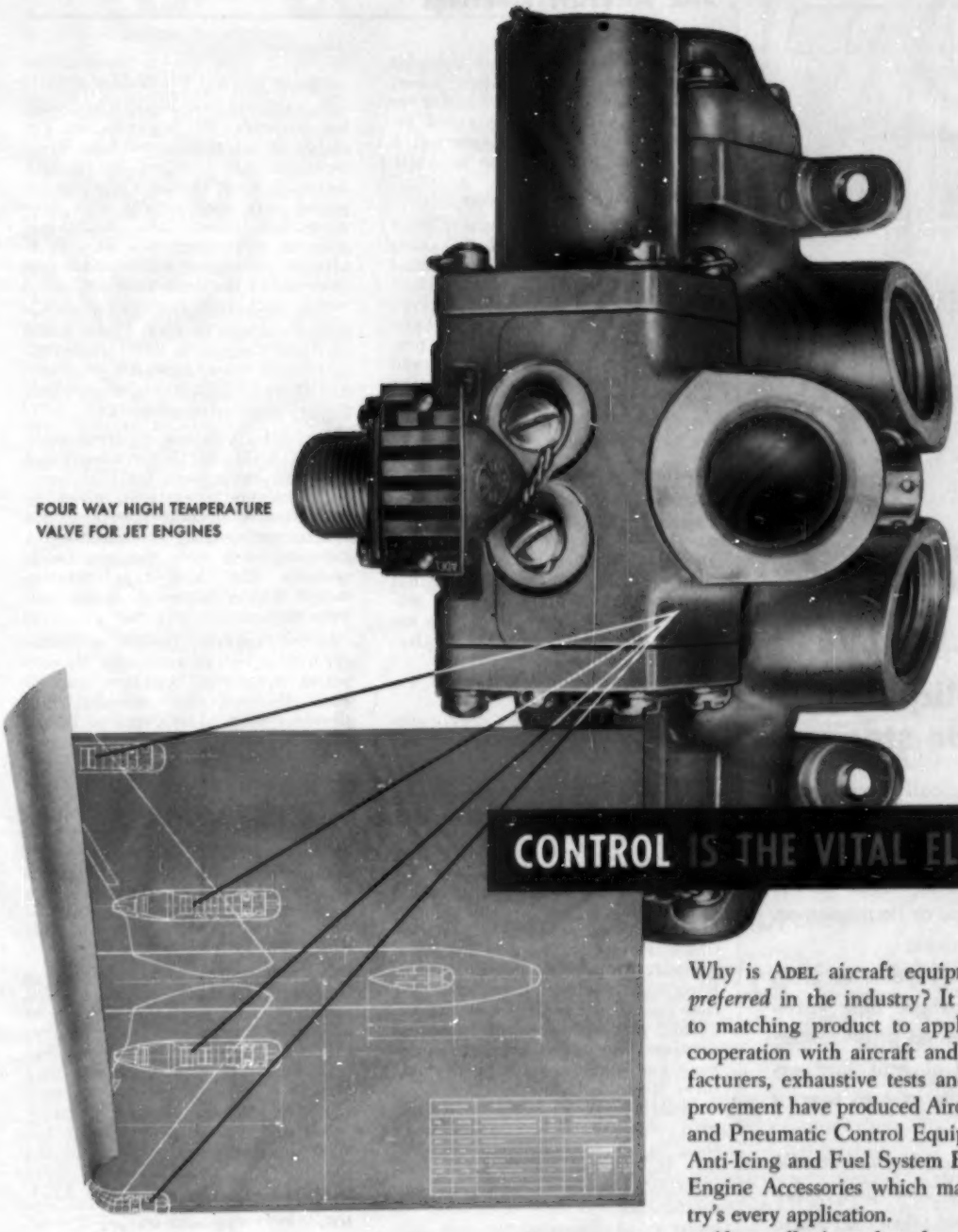

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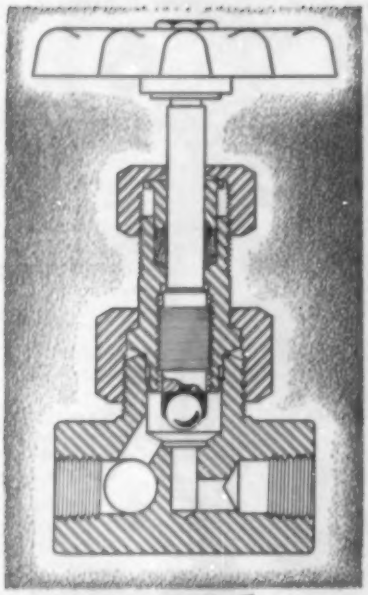

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SAE Aircraft Meetings

1/16 radius on all internal threaded fittings for −12 and larger sizes; and to machine 1/16 chamfer or radius on all external threaded fittings. With Committee approval a final report will be made to AMC.

MIL-H-5512A Hose Assemblies

Wright Air Development Center (WADC) requested that the existing spec be divided into two parts: (1) Hose; and (2) Hose Assemblies. They also asked for a separate spec for reusable hose ends. The chairman asked B. F. Goodrich to prepare the separate spec on hose and Anchor Coupling to prepare the specs on hose assemblies and on reusable hose ends. The latter is similar to MIL-F-5070.

AN6292 Hose Assemblies

WADC reported failures on −8, −10 and −12 sizes of AN6292 hose assemblies. These had been furnished by four vendors. WADC concluded that these assemblies do not meet all conditions now being encountered and requested a hose assembly to meet temperature requirements of −65 to 275 F.

Miscellaneous

North American, Downey, outlined the necessity for a 3000 psi hydraulic hose for a temperature range of 350-600 F (flexible metal).

In response to a request by Douglas Aircraft, El Segundo, on the status of spiral wrapped high pressure hydraulic hose end fitting, both Aeroquip and Anchor Coupling reported very good results with non-winterized inner tube. Additional tests on winterized tube at −55 F after hot air aging will be made and reported at the next meeting.

The representative of ASG reported changes in AND 10050, 10056 and 10057 bosses to avoid radial interference when converting to unified threads. AIA has a Pink Sheet Survey out for coordination.

Republic Aviation reported color coding, AND 100375, for compressed gas, now being used for high pressure pneumatic systems, gives no indication of pressure range of gas or its nature and recommended a separate color code for pneumatic systems. The ASG representative stated that a revised drawing had done this.

BuAer suggested the use of chemical film in lieu of anodizing for corrosion protection. Airframe experience disclosed that chemical film provides very poor abrasion resistance. No action was taken.

New A-6C Committee Holds First Meeting

The SAE A-6C Sub-committee, Hydraulic Pumps, Motors and Air Compressors, which replaced the old A-1 Committee, held their first meeting on Tuesday, April 27, at the Chase Hotel, St. Louis. The SAE Aircraft Accessories and Equipment Division disbanded Committee A-1 that had been handling aircraft hydraulic pumps, motors, air compressors and some fuel system equipment and assigned work on the first three items to Committee A-6.

Chairman B. R. Teree of A-6, in turn, determined that this work should be handled by a sub-committee. Harry Cornish, El Segundo Division, Douglas Aircraft Co. accepted Mr. Teree's invitation to serve as chairman of the new sub-committee. A total of 25 men, representing airframe, engine, pump, motor and air compressor manufacturers, are members of the new group.

Work accomplished by Sub-committee A-6C at its first meeting was divided into two parts, designated "old business" and "new business". Under old business the following principal points were discussed:

High Speed Engine Drive Pads for Generators and Hydraulic Pumps

Pratt and Whitney Aircraft reported that this work is being done by Committee AE-1, Joint Aircraft Engine and Accessory Installations and that A-6C needs take no action unless AE-1 requests assistance.

AND 20000 Series Standard Drive

A representative of Hamilton Standard Division stated that a speed of 8200 rpm for high speed hydraulic pumps was satisfactory; this was supported by other pump manufacturers. Pratt and Whitney remarked that 5000 rpm appears the most efficient speed for constant speed drives. This difference in the 8000 rpm generator drive speed and the 5000 rpm constant speed drive is being studied by Committee AE-1.

MIL-H-7997 Hydraulic Motors

A proposed revision (par 4.5.14.5) of a paragraph dealing with the recalibration of hydraulic motors following endurance testing has been forwarded to WADC by ASG. The change was reported reasonable and likely to be given favorable consideration.

High Speed Hydraulic Pump Specification

Hamilton Standard Division distributed copies of the proposed spec for high speed variable delivery hydraulic pumps. Committee members reviewed the spec in detail and sev-

eral points were agreed upon: (1) the scope of the spec is to be limited to turbine engine installations; (2) capacities of Type 1 and Type 11 pumps were agreed upon; (3) rating was to be changed from 6000 to 8000 rpm; and (4) two classes of pumps were proposed: (a) those with 160 F inlet oil temperature; and (b) those with 240 F inlet oil temperature. A number of other detailed points were also studied and agreed upon.

High Temperature Hydraulic Pump Specification

The Sundstrand committee member reported that the draft of this spec was as yet in rough form. It is based on an inlet oil temperature of 350 F for 400 F system temperatures. The draft will be continued and reported at the next meeting.

Other items discussed were under the heading of new business. The most important of these were:

Air Compressor Specifications

The Walter Kidde member pointed out that revisions in existing specs, particularly hydraulically driven compressor specs MIL-C-8215 and 8216, are desirable. Several detailed suggested changes were considered desirable by the committee. A subcommittee of representatives of Walter Kidde, M. C. Manufacturing and the Cornelius Company are to coordinate the suggested revisions into detailed recommendations for the next meeting.

Constant Displacement High Speed Hydraulic Pump Specification

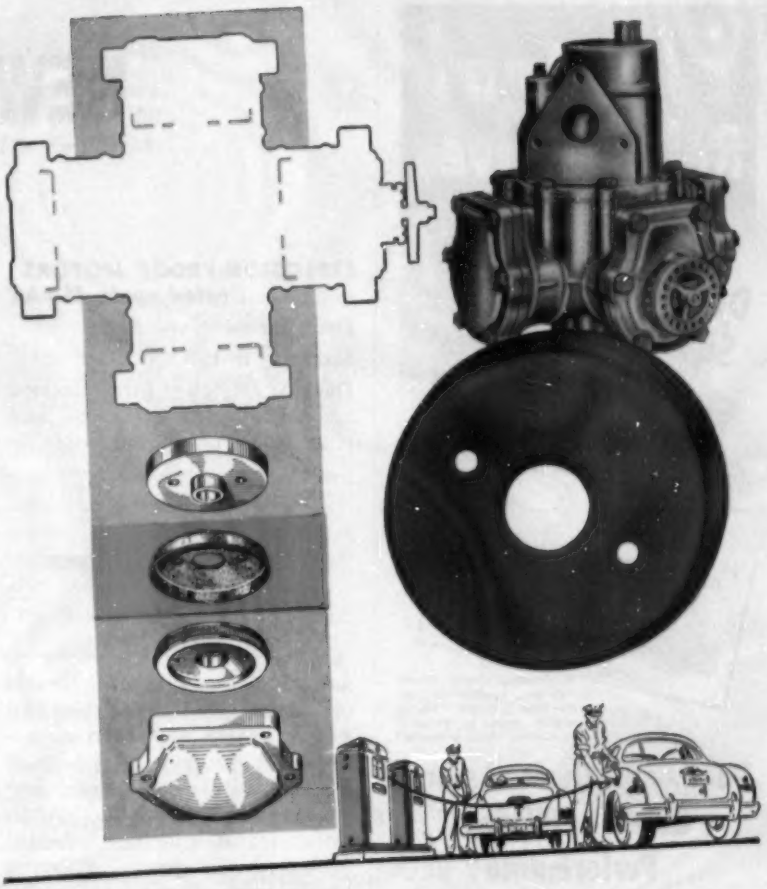
Work on this proposed spec, suggested at the last meeting of A-1, was laid over. North American's Downey member is to survey the airframe industry and report back at the next meeting.

5000 psi Variable Delivery Hydraulic Pump Specification

The Denison Company member presented a rough draft of a proposed spec for a 5000 psi, variable delivery, hydraulic pump. The chairman asked for the same sponsor to conduct a survey and report at the fall meeting. The same member reported on difficulties that were encountered with test circuits for 5000 psi that were not encountered with 3000 psi test circuits. Additional data will be collected for the next meeting.

Hydraulic Pump Back Pressure Limitations

The Northrop Aircraft member reported tests during which back pressure of return ports of hydraulic motors reached approximately 1500 psi due to surges in system return line circuits. The committee agreed that such surges could not be accepted; correction would involve excessive weight and design penalties. It was agreed that the hydraulic system design must accomplish a satisfactory answer.



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Continued from page 20

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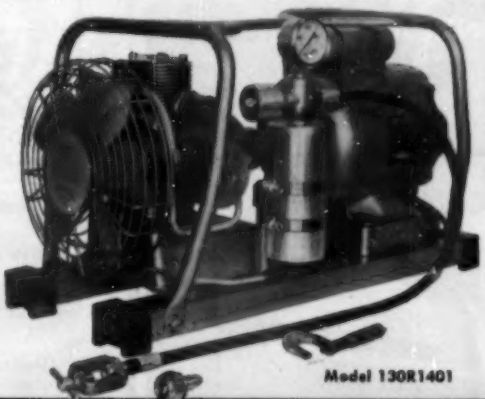

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Continued

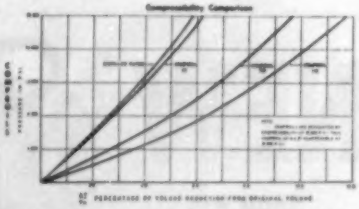
are now available in an expanded line of stock sizes for No. 120 (1½ in pitch), No. 140 (1¾ in pitch) and No. 160 (2 in pitch) chains.

Features: All stock sprockets in the new sizes up to 26 teeth are approximately .40 carbon steel and can be flame hardened to customer order. Easy installation, gripping of both standard and normally undersized shafts with the firmness of a shrink fit, compactness, safety because of no protruding flanges and reusable bushings.

Morse Chain Company,
Detroit 10, Mich.
Circle 161 on Reader Service Card

COMPRESSIBLE LIQUID . . . for "cushioning" applications

Designation: Wales Comproils
Applications: This new development combines the principle of



liquid compressibility at ultra high pressures with lubricity. One of the widest uses of comproils is in "cushioning" applications. They also have varied usage in hydraulic systems.

Hydra Spring Division,
Wales-Strippit Corporation,
North Tonawanda, New York
Circle 162 on Reader Service Card

LIMIT SWITCH . . . gives 11 operating sequences

Designation: Class 9007 Type T
Construction: Diecast enclosures are fully gasketed with neoprene, making them watertight, oiltight and dust tight. Seven types of baseplates, as well as threaded holes in the side of the diecast box, permit mounting in a variety of positions.
Features: Easy adjustment of

the basic device to obtain eleven different contact operating sequences, using only a screwdriver.

Applications: For simplified

stocking, basic switch units and lever arms are individually packaged. Different applications can be met by thus selecting the proper arm for use with the basic switch.

Square D Company,
Milwaukee 12, Wis.

Circle 163 on Reader Service Card

SMALL 4-WAY AIR VALVE
. . . has only one moving part

Designation: Comet

Features: Capable of operating at 800 or more cycles per minute. The valve is one of the smallest 4-way, two position direct solenoid operated units. It may be

mounted directly on welding guns, small jigs and fixtures, small bench machines and similar equipment. It has only one moving part and can be serviced by any maintenance man or by the operator since loosening four screws permits the removal of the cover and disconnects the electrical supply to the solenoid. Taking out three more screws allows easy removal and replacement of the valve body.

Applications: Available in manifold, sub-base, plate mounting

A High Pressure Pump at a Low Pressure Price!

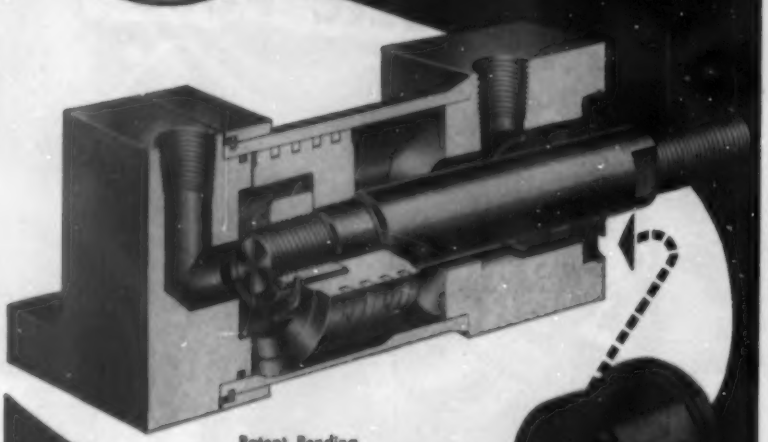
- COMPLETE HYDRAULIC BALANCE . . . the exclusive DUAL-VANE Design provides and assures complete balance of all hydraulic pressure loads. You get continuous, maintenance-free operation with increased efficiency at all pressures.
- INCREASED OUTPUT . . . machine efficiencies can be increased by 2000 psi pump operation without change of other standard components in the hydraulic system.
- CARTRIDGE CONSTRUCTION . . . all pumping parts that move are contained within an easy-to-install cartridge. Pump output can be altered by changing cartridge; servicing is simplified and machine down-time reduced.
- ECONOMY . . . the low initial cost and the 2000 psi premium performance of DUDCO PF-100 Pumps can double the value of your *hydraulic dollar.*

Write for DUDCO Bulletin No. DP-302. You'll get the facts on the new PF-100 Series Pumps.

DUDCO DIVISION
THE NEW YORK AIR BRAKE COMPANY
1704 EAST NINE MILE ROAD • HAZEL PARK • MICH.

Circle 35 on Reader Service Card

High Pressure HYDRAULIC CYLINDERS



Patent Pending

Cut downtime with "quick-change" rod packing cartridge

- 2,000 P.S.I.
- J. I. C. STANDARDS
- COMPACT DESIGN
- OPTIONAL ROD SIZES
- ALL-STEEL CONSTRUCTION
- 11 TYPES OF MOUNTINGS
- 11 BORE SIZES—1½" TO 8"
- UP-TO-DATE ENGINEERING

The S-P "quick-change" packing cartridge is easily removed for servicing seal or wiper. *Cuts downtime . . . speeds production.* S-P Hydraulic Cylinders have *every* modern design feature. Representatives in principal cities. Prompt deliveries. Send for Catalog 104. The S-P Manufacturing Corp., 12415 Euclid Ave., Cleveland 6, Ohio.

THE S-P MFG. CORP. — Cleveland
A Bassett Company
PRECISION PRODUCTS SINCE 1916
AIR AND HYDRAULIC CYLINDERS • POWER CHUCKS • ROTATING AIR CYLINDERS
COLLETS AND DRILL PRESS CHUCKS • AIR PISTONS, VALVES AND ACCESSORIES

NEW PRODUCTS

Continued

and inline pipe-tapped body types. It can be converted to a straightaway or three-way operation by plugging some of the ports. The pressure rating is 250 psig air and the maximum temperature is 180 F. The exhaust is non-piped.

Ross Operating Valve Company, Detroit, Mich.
Circle 164 on Reader Service Card

ELECTRICAL TIMER
. . . has explosion-proof case

Features: Setting knob of the timer is directly connected to the switch operating cam. Thus, since the unit does not set through a clutch, positive switch action is provided. All energy required to operate the switch is built up by the manually setting pointer, thereby relieving motor and clutch of all drag. The switch itself is single-pole, double throw, 1000 watt capacity, fully enclosed. The self-starting, slow speed motor is of the industrial type, synchronous and completely sealed. No energy is required of the clock motor to trip the switch at the end of the preset time.

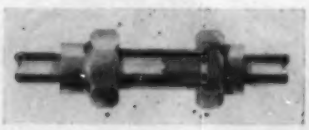
Application: Explosion-proof case provides complete protection where timing operations are required in hazardous locations or on dangerous applications. Can be used to time and control, any electrically operated equipment.

Zenith Electric Co., Chicago 10, Illinois
Circle 165 on Reader Service Card

STRAIGHT LINE STRAINER
. . . reduces turbulence

Size: ¼, ⅜, ½, ¾, and 1 in pipe

Design: Eliminates unnecessary friction, loss and turbulence, un-



ion couplings insure quick installation and cleaning. The large screening area is designed for high efficiency and infrequent strainer cleaning. All parts are non-corrosive.

Applications: Protects appliances, equipment, valves and controls, provides clean, uninterrupted flow of water, air or gas.

Industrial Sales Division,
Hays Manufacturing Co.,
Erie, Pa.

Circle 166 on Reader Service Card

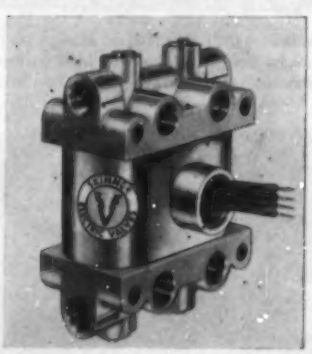
SMALL 4-WAY SOLENOID VALVE
. . . for oil and air

Designation: V9 Series

Size: Pipe connections are ¼ in NPT, electrical outlet is ½ in NPT

Design: Packless, frictionless construction and fast dependable operation through millions of cycles. Direct acting, spring-loaded design assures positive action and bubble-tight shut-off at all ports.

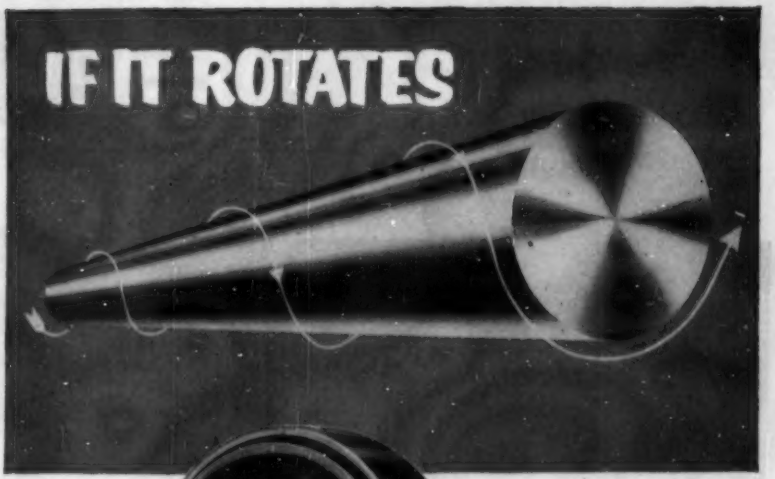
Construction: Bodies are made



of die-cast zinc, internal parts are made of stainless steel. The NEMA class coil is varnish-impregnated and highly resistant to moisture.

Features: Valves are leakproof, suitable for air, hydraulic oils

IF IT ROTATES



SEALOL can seal it!

Pumps, fluid transfers, flexible joints, hydraulic motors, hydraulic actuating devices . . . these and countless other products depend on Sealol for their maintenance-free performance. Sealol Balanced Pressure Seals are usually one of the smallest components in the equipment they serve . . . yet what a difference Sealol Seals make in operating efficiency!

Sealol Seals are handling pressures up to 1500 psi, rubbing speeds to 15,000 FPM, operating temperatures to 500° F. The Sealol *balanced pressure principle* insures close control of face pressure at the point of sealing — resulting in low friction, low torque, minimum heat, and low power loss. Sealol performance improves product performance . . . and reduces product maintenance.

Let's talk it over. Send for NEW Bulletin 7 giving complete details on Sealol Balanced Pressure Seals — or write giving details on your problem for engineering recommendations. Sealol Corporation, 9 Willard Avenue, Providence 5, R. I.

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Chicago • Cleveland • Houston • Los Angeles • Philadelphia
Tulsa • Montreal, Canada • Flexibox, Ltd., Manchester, Eng.

SEALOL

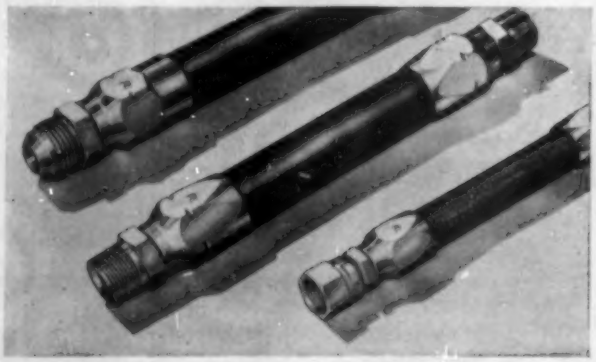
THE BALANCED PRESSURE SEAL

Circle 106 on Reader Service Card

Announcing

Here is *Hoze-lok* showing the type for medium-pressure, rubber-covered, single-wire braid hose. *Hoze-lok* has a unique socket recess to provide greater gripping. It is ***re-usable*** . . . easy to assemble. End of the socket is streamlined with no abrupt corners to cut assembler's hands. See how *Hoze-lok* fittings have a neat appearance in harmony with modern-design machinery.

S.A.E. Standards for hydraulic hose and fittings are fully met by new Parker *Hoze-lok* fittings. See pages 725 and 730 of your S.A.E. Handbook. Or, simply mail the coupon for the reprint shown above.



3 styles for cotton-covered or rubber-covered, single-wire braid hose in medium-pressure service; for rubber-covered, double-wire braid hose in high-pressure service.

Parker Hoze-lok Fittings

For better performance . . . easier make-up . . . greater re-usability and economy

Look at these unique features of Parker's new *Hoze-lok* fittings and hose assemblies for medium and high-pressure hydraulic service:

Hoze-lok fittings offer longer trouble-free service. They have an unusually large gripping area because of their deep socket recesses. They won't pull out.

These new fittings conform to both S.A.E. Hydraulic Hose and Fitting Standards and the hose fitting specifications of J. I. C. Hydraulic Standards.

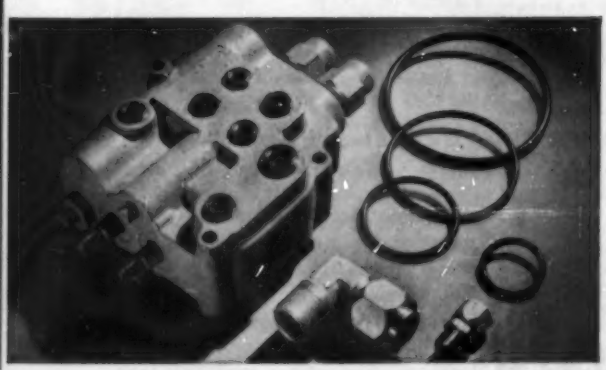
Parker *Hoze-lok* fittings make up easier . . . save time and temper of assemblers. Socket thread is larger than braid diameter, making it easier to insert the hose end into the socket. Contour of the socket provides greater wrench clearance at hex of nipple. Also, this easier make-up simplifies fluid handling for mock-ups or for testing purposes . . . saving expensive engineering time.

Greater re-usability of *Hoze-lok* fittings cuts costs in these ways: Parts of old hose lines can be salvaged, fittings detached and removed. You don't have to carry such a large inventory. A small stock of bulk hose and *Hoze-lok* fittings takes care of most requirements.

Hoze-lok fittings are now available for both medium and high-pressure hose. Also, these new fittings are augmented by a wide range of *Triple-lok* (tube fitting) connecting adapters. Mail the coupon for Catalog No. 4400 and ask for name of nearest *Hoze-lok* distributor.

TUBE AND HOSE FITTINGS DIVISION
The Parker Appliance Company
17325 Euclid Avenue, Cleveland 12, Ohio

Parker
Hydraulic and fluid system components



What other Parker products for hydraulic and fluid systems interest you? *Triple-lok* flare tube fittings? *Ferulok* flareless tube fittings? Hydraulic control valves? O-rings?

TUBE AND HOSE FITTINGS DIVISION
The Parker Appliance Company
Section 405-F
17325 Euclid Avenue
Cleveland 12, Ohio

☐ Please send *Hoze-lok* Catalog No 4400.
☐ Reprint of S.A.E. Standards for Hydraulic Hose and Fittings, Bulletin No. 4405 B1.

NAME _____ TITLE _____
COMPANY _____
ADDRESS _____
CITY _____ STATE _____

Mail this coupon for catalog of complete information about new Parker *Hoze-lok* fittings. If you'd like to know more about other Parker products, please contact Parker for prompt details.

Circle 113 on Reader Service Card

Hydraulics Engineers Specify STRATOFLEX

STRATOFLEX Precision Elbow Hose Fittings are designed and engineered to fill your requirements. Whatever your specifications in detachable reusable hose fittings, and flexible hose assemblies, specify STRATOFLEX!

PRECISION ELBOW HOSE FITTINGS

- AVAILABLE IN ALUMINUM OR STEEL
- ALL SIZES • ANY ANGLE OF BEND
- FLANGE & SWIVEL NUT CONNECTIONS

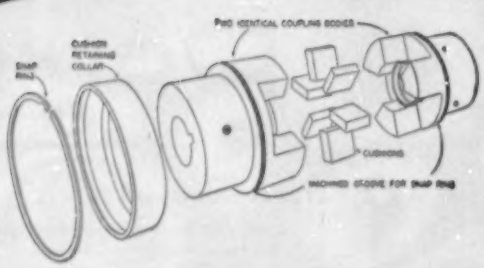
WRITE FOR COMPLETE INFORMATION

STRATOFLEX

STRATOFLEX INC.—FORT WORTH, TEXAS
P. O. BOX 10398

BRANCHES:
ATLANTA • CHICAGO • DAYTON • HOUSTON • KANSAS CITY
LOS ANGELES • MINNEAPOLIS • NEW YORK • TULSA
IN CANADA: STRATOFLEX OF CANADA, INC.—TORONTO 18, ONTARIO

LOVEJOY FLEXIBLE COUPLINGS



- Quickly-Installed
- Double-Life Cushions
- Permanently Non-Lubricating

- Lovejoy's uncomplicated design permits easy, quick installation or removal. Load cushions are in plain sight at all times for rapid inspection and can be removed without tearing down the coupling.
- One-half the cushions act as idlers during operation, except on reversing loads. In non-reversing operations, the cushions can be reversed to double their service life.
- Lovejoy Couplings never require lubrication
- Lovejoy manufactures a complete range of flexible couplings from fractional to over 800 hp. Get full information on this "maintenance-free" line, including catalog with complete specifications and operating capacities.

LOVEJOY FLEXIBLE COUPLING CO.
4837 W. LAKE ST., CHICAGO 44, ILLINOIS

New Products

Continued

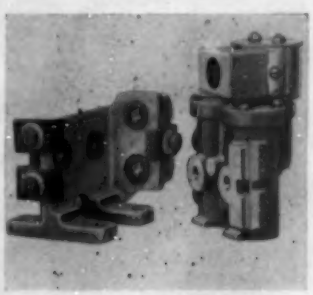
and other common media and will operate in any position. Can control one double-acting cylinder or two single-acting cylinders. 176 standard variations of capacities, metering and types make these valves suitable for numerous applications.

Skinner Electric Valve Division, Skinner Chuck Company, New Britain, Conn.

Circle 167 on Reader Service Card

SUB-BASE MOUNTED CRESCENT VALVES
. . . easily replaced

Features: On production equipment, where maintenance down time is costly, this valve can be



replaced in a matter of seconds. By loosening three holding bolts, the entire valve body can be removed and replaced by a new one. The sub-base remains undisturbed as a permanent part of the piping. The valves are of the Crescent design, pilot operated solenoid controlled 4-way valves, for air, light oil and water. Pressures to 150 psi.

Barksdale Valves, Los Angeles 58, Cal.

Circle 168 on Reader Service Card

MANUAL SHUT-OFF VALVE
. . . has positive seal

Designation: 900 Series
Design: In principle the valve is two valves. The shut-off section, employing an "O" ring, is drawn back into the throttling section when the valve is opened, both actions being accomplished in a single motion. No reversal or abrupt change in direction of

flow takes place within the valve, assuring very low pressure drop even when pressure or flow rate

is high. Rated at 0-3000 psi these valves can be used in either hydraulic or pneumatic service and operate smoothly and easily up to their full rated capacity.

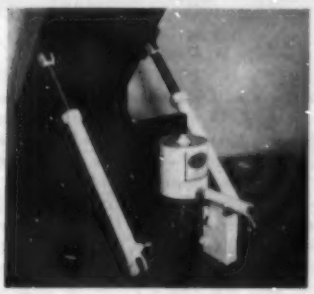
James-Pond-Clark
Pasadena 8, Cal.

Circle 169 on Reader Service Card

HYDRAULIC RAM
. . . is hand operated

Designation: Anco

Design: The unit can be operated in any position and has a



capacity of 2000 lbs. The complete unit consists of two 17 in rams, one hand pump, and a one quart capacity reservoir. Any size and capacity unit can be made to suit requirements.

Anco Screw Products,
East Detroit, Mich.

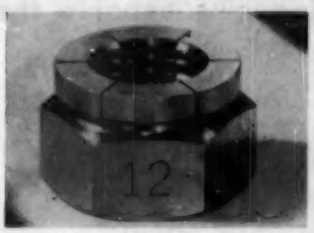
Circle 170 on Reader Service Card

SELF LOCKING NUT
. . . for hot-spot applications

Designation: Flexloc

Size: Seven standard sizes with diameters ranging from No. 10 through 9/16 in. Threads are National Fine series.

Design: Machined from AMS-5642 stainless steel, are heat and corrosion resistant and retain full locking strength at elevated temperatures. They are silver



plated to eliminate galling and seizure of threads. Under test they conform to military specifications MIL-N-7873. The one piece all metal locking nuts are stop nuts as well, they lock in place at any point along the bolt or stud, whether seated or not.

Features: Capable of withstanding the heat in tail cone of a gas turbine, the locknuts are also designed for such hot-spot applications as exhaust manifold systems, furnaces and firewall assemblies.

Standard Pressed Steel Co.,
Jenkintown, Pa.

Circle 171 on Reader Service Card

SUPERIOR Announces New SAE Hydraulic Low-Carbon Steel Tubing

Practically Eliminates Tubing Failure in Critical Hydraulic Systems

Newest product to brighten the eyes of hydraulic engineers and designers is a low-carbon steel tubing that practically eliminates tube failure in hydraulic systems.

JIC specifications were a long step in this direction. Superior's SAE hydraulic tubing goes even further. 100% hydrostatic testing is at pressures which raise the fibre stress to 15,000 psi—in many sizes well above the 1,000 psi minimum required by these specifications. This contributes to greater safety at higher work and surge pressures. Also, we aim for a carbon content of .12% maximum, for ease of bending and flaring. Tube billets are made under special melting practice to insure a NON-AGING type of tubing with low yield strength and high elongation.

If you use hydraulic tubing—and if you want exact analysis, outstanding fabricating ease, and minutely accurate dimensions—specify Superior. Send for Catalog Section 30 and name of your nearest Superior distributor. Superior Tube Company, 2030 Germantown Ave., Norristown, Pa.

COMPARISON OF SPECIFICATIONS

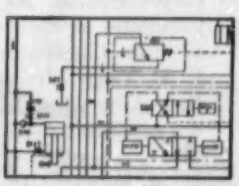
Seamless Low-Carbon Steel Tubing

Detail	JIC	SAE
Check Analysis:		
Carbon	.08-.18	.05-.15
Manganese	.30-.60	.30-.60
Phosphorus	.05 max.	.040 max.
Sulphur	.055 max.	.050 max.
Physicals:		
Ultimate	55,000 psi max.	60,000 psi max.
Yield	— —	25,000/45,000 psi
Elong. 2" a)¼" O.D. x .035" wall and over	40% min.	35% min.
b)Under ⅛" O.D. x .035" wall	30% min.	30% min.
Misc. Tests		
Flare	4" section expanded over mandrel having a 60° angle until inside diameter is increased 30%	
Flattening	3" section flattened to 3 x wall thickness	
Hydrostatic	Not less than 1,000 lbs. pressure	
Corrosion Protection	The corrosion preventive oil used shall be such that after extended storage periods it can readily be removed with an alkaline cleaning solution or Stoddard Solvent.	

Superior Tube

THE BIG NAME IN SMALL TUBING

All Analyses .010" to ¼" O.D.
Certain Analyses in light walls up to 2½" O.D.



Partial plan of complex hydraulic system

Circle 115 on Reader Service Card

APPLIED HYDRAULICS Magazine reports the spring meeting of the

National Fluid Power Association

Officers and directors elected at the spring meeting. Seated, left to right: E. E. Yaggy, Jr., President, Gerotor May Corp., Director; L. S. Barksdale, President, Barksdale Valves, Director; W. J. Donnelly, Works Manager, The Tomkins-Johnson Co., Director; Ben N. Ashton, President, Electrol, Inc., President; John J. Pippenger, Vice President, Double A. Products Co., Director; Barrett Rogers, Executive Secretary; O. Wendell Macy, Sales Manager, Hydraulic Power Div., Hydraulic Press Manufacturing Co., Second Vice President; Standing, left to right: R. J. Murphy, Manager Technical Service, Hydreco Div. The New York Air Brake Co., Director; John A. Marsh, Sales Manager, Rivett Lathe & Grinder, Inc., Director; L. R. Burger, Sales Manager, Logansport Machine Co., Inc., Director; B. R. Teree, Chief Engineer, Aeronautical Div. The Weatherhead Co., Director; John E. Erskine, Executive Vice President, Racine Hydraulics & Machinery, Inc., First Vice President and Elwood G. Peterson, President, Hannifin Corp., Treasurer.

THE National Fluid Power Association held their annual meeting at Edgewater Gulf Hotel, Edgewater Park, Mississippi on April 5, 6 and 7. A total registration of nearly 100 representatives of member and prospective member companies attended. While a considerable part of the sessions was devoted to reports by standing and product sections committees, the general concensus was that the meeting represented a definite advance in the development of a strong general program for the Association. Several of the product section reports indicated that a remarkably good beginning has been made.

On the 5th, meetings were confined to morning meetings of the Executive Committee and informal meetings of committees.

Morning and afternoon sessions were held on the 6th and 7th. After Chairman John Hanna's introductory remarks at the morning meeting on the 6th and the announcement of the Executive Committee's committee appointments, reports were made by officers and chairmen of the standing committees. E. G. Peterson made his treasurer's report, indicating that the Association was in a sound position. J. J. Pippenger reported for the Executive Committee on changes recommended in the Constitution and By-laws. E. E. Yaggy, Jr. reported on the Rules Committee. J. A. Marsh gave the Nominating Committee report. The new slate of officers, reported below, were selected. The Executive Secretary Barrett Rogers reported a total of 58 members and 6 applications.

After luncheon at which George A. Giese, Vice President, Dun & Bradstreet, Inc., spoke on "Business Trends", the afternoon sessions, presided over by Vice Chairman John E. Erskine, heard reports of the standing committees and of the Educational and Government Relations Committees. Ernst Wiedmann, chairman, Terms & Graphic Symbols Committee, distributed copies of the tentative Glossary of Terms for Fluid Power and reported on the soon-to-be-released ASA Drafting Standards. O. Wendall Macy, chairman, Uniform Ratings Committee, announced the breakdown of this committee into five working groups, General Rating Problems, Pumps and Fluid Motors, Cylinders, Valves and Related Components. B. F. Quintilian, chairman, Defined Projects Committee, outlined the first project on Fire Resistent Fluids, which will be directed primarily to collecting pump experience among Association members. Frank Flick, chairman, Design Standards Committee, outlined the

DON'T TAKE CHANCES...

Use Celanese*

LINDOL* HF

the flame-resistant hydraulic fluid

PROVED IN 10 YEARS OF DIE-CASTING APPLICATIONS

- chemically stable
- non-volatile
- odorless
- low pour point
- non-corrosive
- excellent lubricant

Lindol HF—with over 10 years of on-the-job experience—provides an extra margin of safety for operators of hydraulically-activated machines. More and more plant managers today depend on Lindol HF to minimize the hazards of line breaks, leakage caused by vibration, and other mechanical failure.

Developed by Celanese, pioneer in flame-resistant fluids, lubricants, and additives, Lindol HF remains stable at the highest temperatures. It is unaffected by customary thermal and mechanical stresses . . . yields no obnoxious fumes since it contains no chlorine, nitrogen or inorganic salts.

Only minor adjustments, at most, are needed for immediate switchover to Lindol HF—in die-casting equipment, couplings, rams, presses, welding or riveting machines. Write for detailed bulletin.

Celanese Corporation of America
Chemical Division, Dept. 588-F
180 Madison Avenue, New York 16, N. Y.

CELANESE* LINDOL* HF

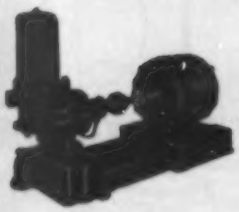
Appearance	Clear
Specific Gravity 20/20° C	1.160 ± .008
Boiling Range @ 10 mm. Hg. °C	255-295
Volatility, 6 hrs. @ 100° C, % max.	0.1
Flash Point, °F Tag open cup	440-465
Fire Point °F Cleveland open cup	685
Auto Ignition Temperature, °F	over 1100
Viscosity Range, Seconds Saybolt Universal @ 25° C	240-325
Pour Point, °C	—25 to —30
Weight, lbs./gal. @ 20° C	9.7

Celanese® CHEMICALS

*Reg. U. S. Pat. Off.

● Since 1928 ● in the application, design and manufacture — pumps, separators, hydraulic accessories.

EQUIPMENT FOR FLUID POWER TRANSMISSION



Rotary Air Pumps for vacuum bottling

Kraissl's patented, automatic, force-feed lubrication and flushing system makes these direct-drive, high-capacity pumps ideal for the special requirements of bottle-filling machinery.

Air-cooled design—or water-cooled models for heavier duty.

Class 21 roller-action pumps are recommended for handling corrosive gases and extraneous matter that might jam with closer clearances. The multi-blade design of the Class 25 pumps gives higher capacity efficiencies and is designed for applications requiring higher degree of vacuum.

Where water-cooling is desired for continuous service, the water-jacketed Class 25-WJ models are recommended.

Our exclusive Class 26 design air filter can be furnished as an integral part of each pump, up to 10 cfm—to produce oil-free discharge air and also conserve the lubricating oil.

Write today for Bulletin A-1289, for air-cooled pumps—and for A-1823 for the water-cooled models.

KRAISSL CO

308 Williams Ave., Hackensack

National Fluid Power Association

progress made in various component subcommittees to date.

Clifton N. Lovenberg, reporting for the Education Committee in the absence of chairman Frank X. Cascone, detailed the initial work done on a bibliography at Brown University. He also read the minuates of the January 19th Detroit meeting of the Educational Committee. L. E. Shea, in the absence of chairman J. G. Jones, made a brief report on the Government Relations Committee.

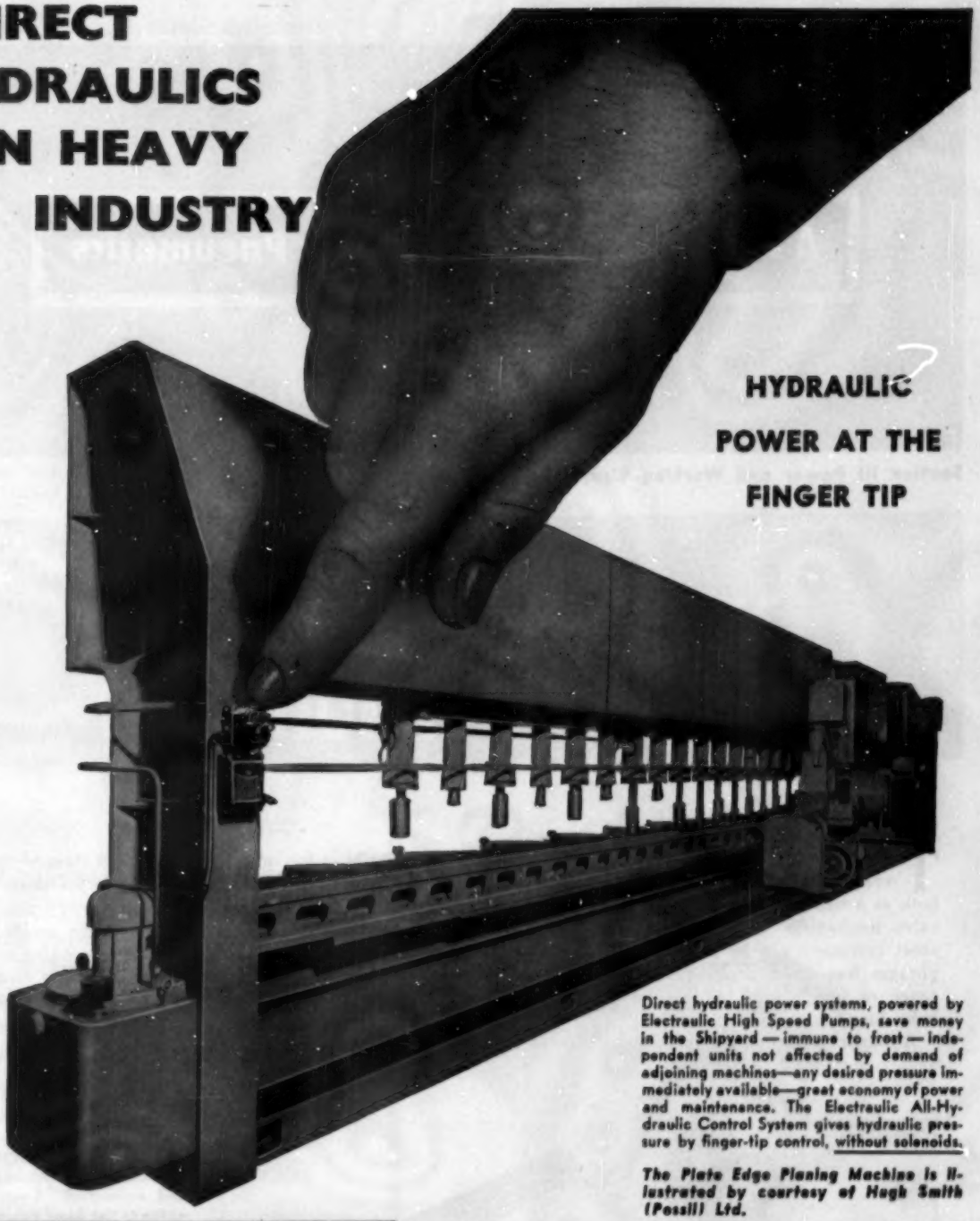
At the morning session on the 7th, Mrs. Hymen Ledeen gave a very interesting paper on "Use Taxes", discussing the difficulties of both manufacturers and distributors in complying with divergent state laws. Most of the morning was taken up with separate Product Section meetings. Four meetings were held: Pump Section; Cylinder Section; Valve Section and Related Components Section.

Dean Robert W. French of Tulane University spoke at the luncheon on "Industrial Development and Markets of the Deep South". At the closing afternoon session it was announced that the fall meeting would be held at the Hotel Commodore, New York City, on September 7, 8 and 9. The officers for the coming year are: Ben N. Ashton, President; John E. Erskine, First Vice President; O. Wendell Macy, Second Vice President; E. G. Peterson, Treasurer. L. S. Barksdale, L. H. Schuette and R. R. Teree were elected to three year terms as Directors and R. J. Murphy was elected to a two year term.

Ben N. Ashton, President, National Fluid Power Association

Members and guests at the National Fluid Power Association annual meeting.

DIRECT HYDRAULICS IN HEAVY INDUSTRY



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The Plate Edge Planing Machine is illustrated by courtesy of Hugh Smith (Possil) Ltd.

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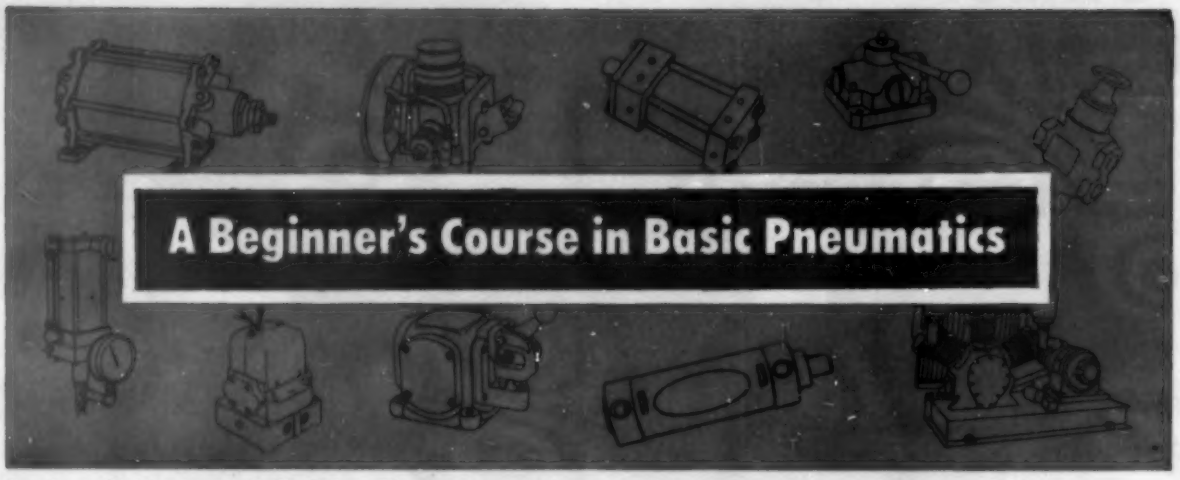

Section III Power and Working Elements

Air Valves

Part 8

Diaphragm Valves

THE diaphragm was one of the earliest developed means of operating valves. The diaphragm is used both as a basic operating means and as an auxiliary valve mechanism where the flat disc principle for short movement can be used to advantage. The diaphragm has given designers of air valves a wide range of possibilities in different constructions for valve functions.

A diaphragm in itself may be metallic or an elastic material in the rubber family. Either class of material lends itself to the flat disc principle for short movement.

To illustrate a principle where the molded diaphragm of elastic material serves as a valve mechanism in itself, see Figure 1. This is a true on-and-off valve providing a three way principle of operation. This valve is extensively used in industry and has found great favor with those who like simplicity.

Fig. 1. THE MOLDED DIAPHRAGM in this hand operated on-and-off, 3-way valve serves as the basic valve mechanism.

Fig. 2. AN ON-OFF AIR valve with adjustments for travel to give a selection of radial directions for the handle operation provides large capacity with fast operation. The combination of poppet and diaphragm gives large flow with relatively small valve movement.

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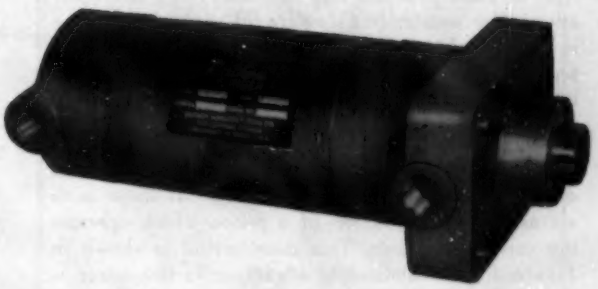

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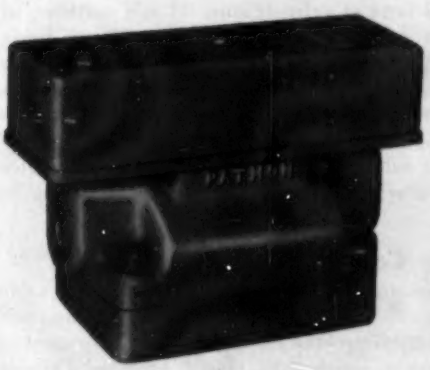

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Figure 2 illustrates a similar structure but with refinements of adjustments that gives a choice of different radial directions for the handle operation. This type of valve provides large capacity with fast operation. The outstanding feature of such a structure is its small size and simplicity with the advantages of a poppet valve mechanism to provide large flow capacities with relatively small movement of the valve itself.

Use of Molded Diaphragm

In addition to being a valve mechanism, the molded diaphragm has many other uses. One of these is to act as the control means of a piston which operates the valve mechanism. This construction is shown in Figure 3. The outstanding advantage in this usage is that no leakage is encountered, as is normally associated with a moving piston, making it practical to use the structure for timing objectives in a control circuit. The structure shown in Figure 3 is unique with respect to its valve mechanism in that either normally open or normally closed operation can be obtained merely by the choice of pipe connection. In addition, this type of construction also lends itself to pilot pressure on the underside of the diaphragm to counteract the pilot pressure above it.

The diaphragm has another broad usage in which might be termed the "pressure control field". Figure 4 shows a manually operated valve in which a diaphragm is used with a valve mechanism in such a way as to produce an outlet consistent with handle position. It is, in effect, a servomechanism within itself and has the ability to be self-compensating for leakage or temperature change. In use, the valve mechanism operates to pass a predetermined air pressure to an objective; this air pressure is maintained when the original objective has been reached.

The ball form of valve (Figure 4) is a variation of the poppet valve. This type has the quality of being self-centering, an advantage in holding leakage to a minimum even with the misalignment inherent with a floating diaphragm. The ball arrangement also has the tendency of being somewhat self-cleaning. In operation the exhaust valve closes before the inlet valve opens in a series action with practically no lap in between.

Pressure Control Relays

The pressure control principle in this type of valve provides the means to control positioning devices and the ability to control the intensity of an engagement of such devices as clutches. Further, it provides a simple means for the control of forces which blend well with the fields of tension control.

With the valve just discussed, which may be identified as a sender, it is often necessary to use a pressure control type of relay to repeat the action of the sender where greater capacities are desired. Furthermore, it may be desirable to use a relay valve where long distances are involved and large pipe sizes are undesirable. Again, faster action can be obtained in long distances when relays are introduced between the sender and receiver. Figure 5 illustrates a diaphragm type of valve which is called a relay. Its function is to always repeat whatever pressure is imposed upon its control portion. In this case, a unique application is shown of the poppet type valve mechanism. The valves

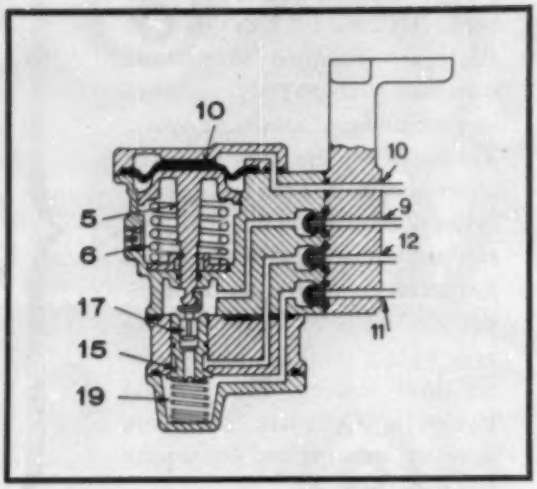


Fig. 3. A MOLDED DIAPHRAGM is used here to control a valve piston. This type of valve can be operated normally closed or normally open by a choice of pipe connection. The leak-proof construction makes this design desirable for accurate sequencing in a control circuit.

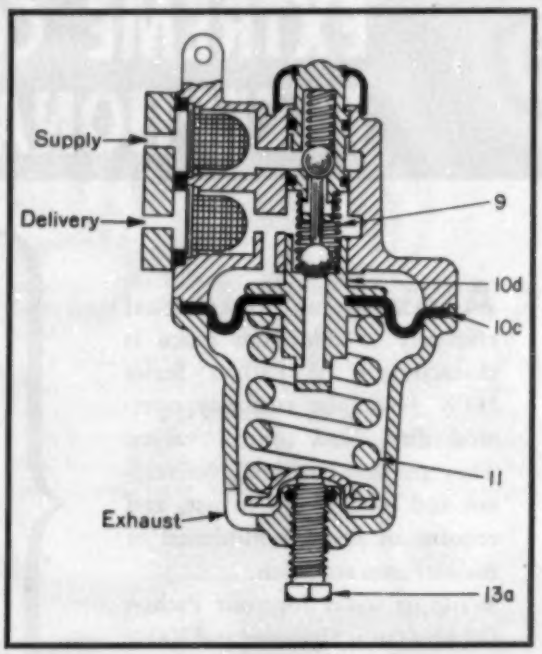


Fig. 4. THE DIAPHRAGM in this manually operated pressure control air valve provides an outlet pressure consistent with handle position. The diaphragm, in combination with the valves, acts as a servomechanism, being self compensating for leakage or temperature change.

. . . this is the final article of this series. Basic Pneumatics will be reprinted as a book . . .

are so constructed that the areas exposed to pressure are substantially balanced so that very little force is required to operate them. This makes it possible to obtain very close control of delivery pressure in response to the signal pressure on the diaphragm.

In operation, whenever a specific or signal air pressure is imposed upon the top of the diaphragm, the diaphragm with its attached piston arrangement moves down to close the exhaust valve and open the supply valve. Air then passes on to the receiving device and

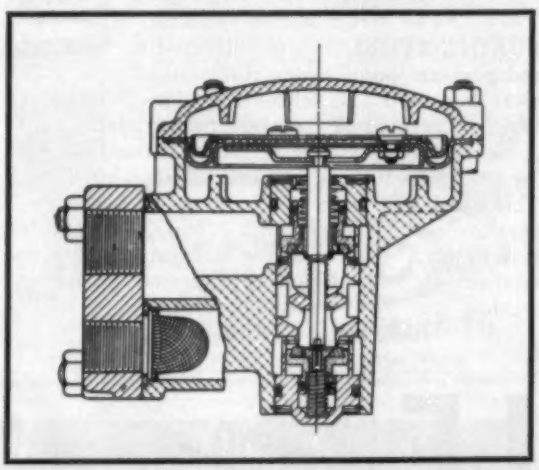


Fig. 5. THE DIAPHRAGM in this pressure control type of relay operates with very little force as areas exposed to pressure are substantially balanced. Very close control of delivery pressure in response to signal pressure on the diaphragm is obtained.

at the same time to the underside of the diaphragm. When the pressure of the diaphragm is substantially equal to that above it, the supply valve closes. If the signal pressure were reduced on the control diaphragm, the exhaust valve would open and the pressure to the receiving device and also to the underside of the diaphragm would be reduced until the diaphragm was again in balance. It will be obvious that the relay has the same property of compensating leakage and temperature change as the control valve (Figure 5) noted above.

It should be remembered, however, that the relay valve repeats signal pressure, while the control valve (Figure 3) is intended to be used as an on-an-off control.

The most common use for the metal diaphragm is illustrated in Figure 6 where it is used in a pressure

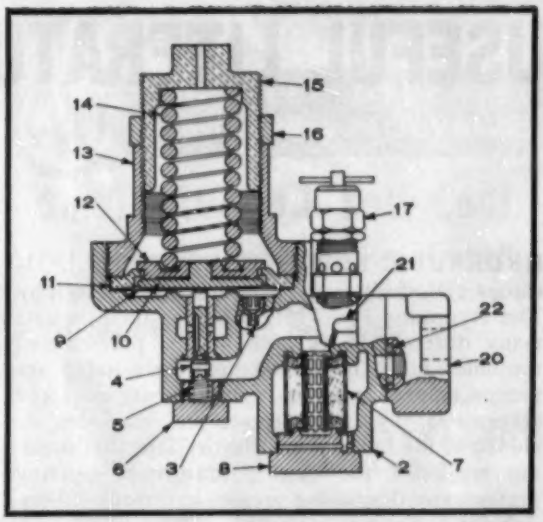
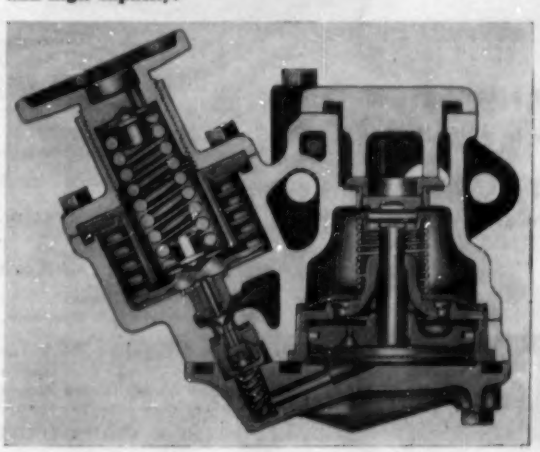


Fig. 6. A METAL diaphragm is often used as in this pressure reducing valve where the inherent advantages of the short, fast diaphragm movement contribute to a compact envelope design.

reducing valve. The diaphragm operates a poppet type valve mechanism. The advantages of short, fast movement and compactness of design are clearly illustrated.

An interesting variation for a pressure reducing valve uses an accordian type metallic diaphragm. A cross section view of this valve is shown in Figure 7. A diaphragm of this design was selected to provide the movement required for a valve mechanism in the smallest dimensions. The valve also had a requirement of considerable movement and low force. This is a type of valve used on railways as a part of the brake system and is identified as a feed valve, this term being historic in this field.

Fig. 7. THE ACCORDIAN type metallic diaphragm is shown in a feed valve, a modern version, pioneered for railway brake systems. This type is well adapted to a valve that requires considerable movement and low force and high capacity.



We are indebted to F. S. Whaley, Industrial Products Division, Westinghouse Air Brake Company in the preparation of this article. Illustrations are published through the courtesy of the Westinghouse Air Brake Company.

USEFUL LITERATURE

You'll find many valuable production and design ideas in publications described here . . . copies will be sent you free without obligation

Continued from page 40

HYDRAULIC POWER EQUIPMENT . . . is shown pictorially in a 4 page bulletin released by The Hydraulic Press Mfg. Co. The bulletin lists many different types of hydraulic presses and machines made by the company. Included are pumps, motors, cylinders, valves, power units and accessories. Types of presses and machines included in the bulletin are plastics injection molding machines, die casting machines bending presses, metal working presses and many others. Ask for bulletin No. 5401.

Circle 215 on Reader Service Card

HYDRAULIC CYLINDERS . . . Custom built to serve any industry are described in a 4 page bulletin prepared by Benton Harbor Engineering Works, Inc. Numerous illustrations are given of special applications and many of the cylinders with their specifications and mountings are also illustrated. The cylinders shown were built on order. They are available for 1500 psi and 3000 psi in sizes from 1½ in to 8 in bore and up to 156 in stroke.

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TUBING STEEL . . . for elevated temperature and pressure applications is described in a technical data card 151, released by The Babcock & Wilcox Co. One of the alloy tubing steels used in elevated temperature service discussed is Croloy 9M (8 to 10% chromium, 1% molybdenum). This steel has wide applications in high temperature service where high corrosion resistance is desirable. Included in the bulletin are data on mechanical and physical properties, bending, welding and heat treatment.

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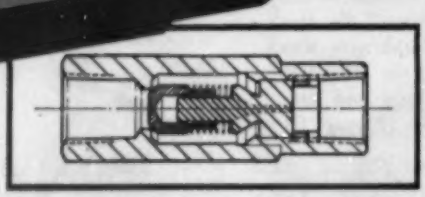

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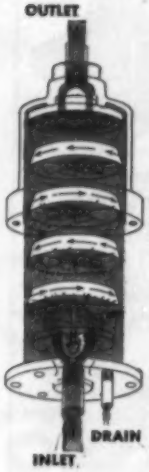

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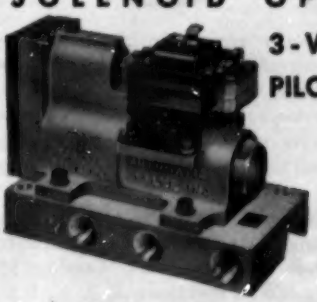

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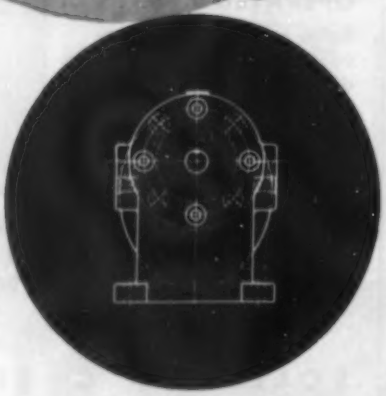

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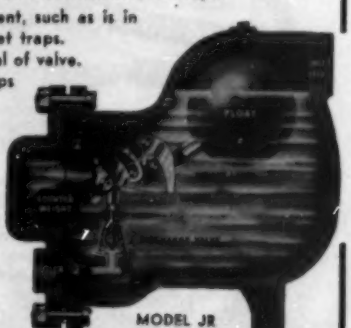

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ITEM #1036—Groban Double acting hydraulic cylinder. 3" bore, 36" stroke, ½" pipe thread ports. 1½" solid steel shaft. Overall length closed 49". clevis mounting at base and shaft. FEATURES • Cup & Chevron Packing • Precision Ground and Honed Construction • Will lift 7000 lbs. using 1000 P.S.I. line pressure. Weight (net) 57½ lbs. F.O.B. Chicago **50.00**

ITEM #224—Groban—Double acting hydraulic cylinder. 3¼" bore, 24" stroke, will lift 8250 lbs. with 1000 P.S.I. line pressure. ½" pipe thread ports—1¾" stress-proof ground, polished & plated solid steel shaft. Overall length closed 36". Ship. Wt. 50 lbs. F.O.B. Chicago **39.60**

ITEM #203—DOUBLE ACTING CYLINDER—2½" bore, 17" stroke, clevis mounting on shaft and trunion mounting on base, all aluminum construction, with stainless steel shaft, 1¼" dia., ⅜" tubing ports, fittings to ⅜" M.P.T. 50c each. Overall dimensions closed 31". Weight 14 lbs. F.O.B. Chicago **21.50**

ITEM #16-C—1½" bore, 26" stroke. Will lift 1760 lbs. with 1000 lbs. pump pressure. Great for hay loaders, etc. 1" stainless steel piston rod. Postpaid **16.95**

ITEM #31C—Double action hydraulic cylinder, 3½" bore, 11" stroke. Alloy Steel Cylinder wall and all steel 1⅛" diameter piston rod. 19½" overall length closed. Clevis mounting at base and shaft. Will lift 9625 lbs. with 1000 PSI pump pressure. Uses ⅜" tubing fittings. (Fittings to pipe thread: two ⅜" MPT @ 35c.) A $102.00 value. Shipping wt. 11 lbs. F.O.B. Chicago **25.00**

ITEM #41CIC • 2" Bore • 6" Stroke • Double Acting • All Steel • ⅜" Pipe thread ports. Lift capacity 3100 lbs. with 1,000 P.S.I. line pressure. Ship. wt. 12 lbs. F.O.B Chicago. Price ea. **12.50**

GROBAN HYDRAULIC SPEED REDUCER WITH FINGERTIP CONTROL

USE FOR: • Reamer Drives • Midget Cars • Feed Mills • Canning Machines • Conveyors • Lathes • Milling Machines • Motor Boats • Cream Separators • Garden Tractors • Pumps. Variable output speeds from 0 to input speed available by moving control handle. Locking handle maintains setting. Use input power of ¼ to 1½ H.P. Shafts ⅝" diam. Input rotation counter-clockwise facing shaft. Input speed 750 R.P.M. 7½" x 7½" x 11½". Gov't. acquisition cost $428.00. Shpg. wt. 31 lbs. Complete with 2 qts. of oil and full instructions. F. O. B. Chicago **54.50**

ITEM #115

GROBAN FOUR-WAY, OPEN CENTER

HYDRAULIC CONTROL VALVE

ITEM #126—Four-way open center control valve, with built-in adjustable relief valve factory set at 1000 P.S.I. Spring loaded neutral position. For use with one double acting cylinder. In neutral position cylinder is locked and pump unloaded. Can be used as single unit or mounted in series. Has ⅜" pipe thread inlet and outlet. ½" pipe thread cylinder ports. Newly manufactured. Ship. wt. 10½ lbs. An outstanding buy! F.O.B. Chicago **21.50**

SAVE $30.30 ON THIS BRAND NEW

PESCO HYDRAULIC CONTROL VALVE

ITEM #371V—For safe, positive control of Hydraulic Cylinders and Motors— • BUILT-IN RELIEF VALVE—factory set at 1200 P.S.I. • FOUR WAY VALVE—to operate one double acting cylinder. • OPEN CENTER—with valve in neutral, cylinder is locked in position and pump is unloaded. • SPRING RETURN TO NEUTRAL • FULLY BALANCED PLUNGER • EASILY STACKED INTO 2, 3, or 4 valve combinations for multiple cylinder operation. • 8 gal. per min. capacity, at 1500 P.S.I.—⅜" pipe ports. • CONNECT PUSH RODS TO HANDLE FOR REMOTE CONTROL. • EASY MOUNTING • LIST PRICE—$46.80. • YOU SAVE $30.30. • DIMENSIONS —9"x4½"x2½" Wgt.—8 lbs. F.O.B. Chicago ... **16.50**

BRAND NEW BERRY—HEAVY DUTY

HYDRAULIC PUMP or MOTOR

ITEM #166—Use on road machinery, vibrators, paper mills, wire reels, hydraulic presses, speed control units. Ball bearing construction, balanced cam design assures high efficiency performance. When used as a pump: delivers 11 G.P.M., 1000 P.S.I., 8 H.P. At 1800 R.P.M. as a HYDRAULIC MOTOR: Rated up to 12 H.P., up to 2400 R.P.M. Standard ¾" pipe thread ports, ⅝" shaft with keyway. Dimensions: 14½"x 8"x 7".

Weight 63 lbs. Regularly $212.00. OUR SPECIAL PRICE 2 for $110 F.O.B. Chicago—ea. **59.50**

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Pneumatic Control
REDUCES WEAR AND TEAR ON PAPER MACHINE

Thilmany Pulp and Paper Company, Kaukauna, Wisconsin, selected Westinghouse Air Brake Co. Pneumatic Control to assure smooth, shock-free operation of a new paper machine. Westinghouse Valves are used to precisely adjust pneumatic clutches and brakes on the dryer rolls, couch, presses, calendar, and reel.

The great accuracy of Westinghouse Valves enables the operator to apply air pressure very gradually to prevent rapid, abrupt engagement of clutches. And he can accurately regulate the amount of braking on any roll. As a result, he can control the tremendously big rolls on this machine smoothly and gently to prevent torn paper and undue wear on clutches.

Wherever you need precise control of linear motion —on brakes, clutches, small presses, positioning devices, sequencing mechanisms, and the like—investigate the possibilities of Westinghouse Pneumatic Control. Our engineers will be glad to help you. Just write, explaining your problem.

Westinghouse Air Brake
COMPANY

INDUSTRIAL PRODUCTS DIVISION WILMERDING, PENNA.

Factory Branch: Emeryville, Calif. Distributors throughout the United States... See your classified directory. Distributed in Canada by: Canadian Westinghouse Co., Ltd., Hamilton, Ontario.

Manufacturers of air compressors, pneumatic cylinders, actuators, air control devices of all kinds, engineered pneumatic control systems and front end loaders.

USEFUL LITERATURE

Continued

new mounting dimensions. It will be useful as a handy reference for sales personnel who require quick comparison of dimensions. The single page chart shows at a glance comparative dimensions of open type and for fan-cooled type polyphase induction motors.

Circle 220 on Reader Service Card

ROLLER FOLLOWER . . . offers the machine designer a roller follower and a high capacity roller bearing in one unit. A complete description of the unit is given in bulletin No. SF-80 released by Roller Bearing Company of America. Dimensions are tabulated for each bearing number along with capacities for various rpm's. The capacities are based on outer race rotation with respect to load.

Circle 221 on Reader Service Card

RUBBER "O" RING SEALS . . . A new 16 page brochure describing in detail the production and application of "O" rings has been published by Minnesota Rubber and Gasket Co. Included are

Cover Band
Holds
Spring automatically in place preventing ring from opening up
Here

Stops Build Up of Ice,
Mud or other Foreign Bodies between Rod and Ring . . .

The wiper edge of the FALL Wiper Ring is TIGHT against the piston rod at all times REGARDLESS OF WEAR. Spring-Loaded, it gives wiper edge a squeeze grip action . . . the squeeze grip is always the same because of the uniform tension of the spring under the endless cover band.

Squeeze Grip Action Does It—*patented*

Ice, grit and other foreign bodies do NOT Build Up under ring. Rod does not stick or become immobile in ANY temperature . . . the FALL ring has complete contact on rod ALL WAYS, always.
Insist on FALL Wiper rings. Available from ½" to 13" dia. Military part numbers from AN6231A1 to AN6231A71. Write, wire or phone us your wiper needs.

Used During World War 2 and ever since by the Military.
Fall Wiper Rings Spec MIL-S-5049 are AN approved.
Covered by patents issued and patents pending.

Ace Products Co., Toledo 1, Ohio. Phone ADams 0513

Ask About FALL Wiper Rings with Closed Joint
Especially designed for those applications where absolute freedom from dirt passing through joint of ring is required.

You can depend on ACE PRODUCTS—Established 1935!

Fall Wiper Ring SPRING LOADED

Circle 126 on Reader Service Card

Circle 1 on Reader Service Card

Circle 58 on Reader Service Card

Announcing

New J. I. C. Wiring Boxes

at sensationally low prices

These rugged steel wiring boxes are completely oil and water splash proof as well as dust proof. THEY COMPLY WITH ALL J.I.C. ELECTRICAL SPECIFICATIONS FOR JUNCTION BOXES. There are no screw holes in the cover or knockouts to admit oil. The neoprene rubber gasket on the cover provides a tight seal. The cover can be removed by loosening *only* one screw. Most sizes may be obtained with a removable panel plate for mounting terminal strips or other electrical equipment.

Ideal for Machine Tool Wiring

Many purchasers now demand that the electrical wiring and controls for machine tools be enclosed in oil-tight boxes. When oil, chips or water get into the machinery electrical circuit, the resultant "down time" is costly. Hoffman J.I.C. wiring boxes help eliminate this trouble. Ford, General Motors and Chrysler are some of the users of these new junction boxes.

Write today for a sample. Standard sizes are:

4" x 4" x 3"	10" x 8" x 4"
6" x 4" x 3"	12" x 10" x 5"
6" x 6" x 4"	14" x 12" x 6"
8" x 6" x 3½"	16" x 14" x 6"

Prices range from $2.75 to $9.95

HOFFMAN ENGINEERING CORP.

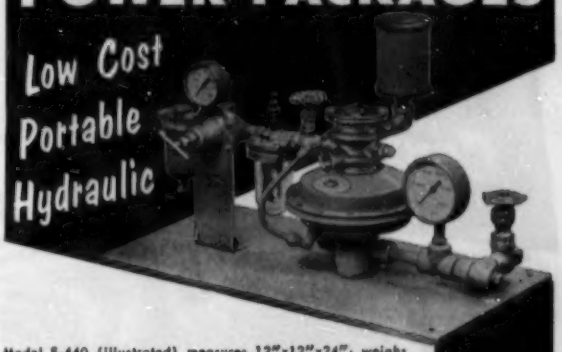
Manufacturers of Wiring Troughs & N.E.M.A. 12 Panels

Anoka, Minnesota

Circle 129 on Reader Service Card

POWER PACKAGES

Low Cost Portable Hydraulic



Model S-440 (illustrated) measures 12"x12"x24", weighs 45 lbs. Contains air-operated pump, air muffler, air filter, air lubricator, air regulator, valves and gages and all necessary equipment for immediate operation.

Make just three connections and you are ready to boost 100 psi. plant supplied air pressure to 10,000 psi. fluid pressure for $278.25 (FOB Gardena, Calif.). Eight standard models for output fluid pressures of 1,000 to 30,000 psi. Special models for lower or higher pressures.

Applicable wherever low volume output at high pressures is the requirement. For oil or water service. Thousands in use. Send for bulletin No. 500.

SPRAGUE

Engineering and Sales Corp.

1144 WEST 135TH ST., GARDENA, CALIF.

Ad No. 225

Air and Hydraulic Cylinders

FOR HEAVY-DUTY AND STEEL-MILL APPLICATIONS

TO MEET ALL SIZE AND PRESSURE REQUIREMENTS

8½-in. bore by 36-ft. stroke cylinder built by Lincoln for steel-mill equipment applications.

2-stage 5000-psi cylinder built by Lincoln for cold-extrusion press. Dimensions: 20-in. bore by 19-in. stroke, and 4-in. bore by 19-in. stroke.

BORES TO 36 IN. DIAMETER STROKES OF 50 FT. AND LONGER

LINCOLN MACHINE COMPANY will design, engineer and build standard or special hydraulic and pneumatic cylinders with trunion, rod-end flange, blank-end flange, foot, clevis or center-line mountings.

Call on LINCOLN when you require large, powerful rotating or non-rotating hydraulic cylinders, heavy-duty mill-type cylinders, or standard hydraulic and pneumatic cylinders. Our engineering department will give you fast, practical assistance in design problems . . . AND our modern plant will build your cylinders quickly and economically.

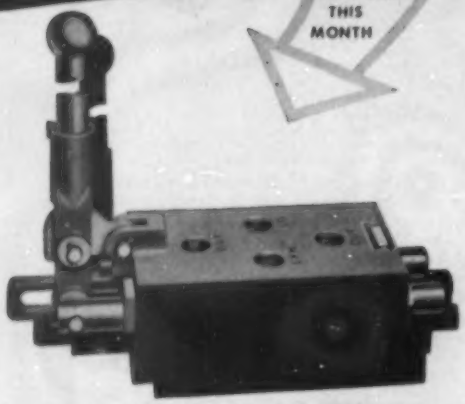
WRITE TODAY FOR LINCOLN'S CATALOG. It gives engineering data on many types and sizes of heavy-duty cylinders.

LINCOLN MACHINE CO. INC.

326 WEST 2nd STREET • SALEM, OHIO

Quick-As-Wink
AIR AND HYDRAULIC
Control Valves

FEATURE THIS MONTH



Lever Operated Hydraulic Valves
For line pressures up to 5000 psi

● Unsurpassed for efficient trouble-free service controlling single or double acting hydraulic cylinders and other important high pressure hydraulic circuits. Positive, fast acting. All parts are in pressure balance, eliminating any tendency to creep or crawl. Machined steel housings, with chrome plated and polished stainless steel plungers. Self sealing U-packers. Metal valving rings take the impingement of the liquid, minimizing wear on the packings. ⅛" to 1½" sizes. Also available in pilot operated designs; sizes to 4". Write for details.

also the following

PILOT CYLINDER OPERATED HYDRAULIC VALVES

Two position valves 1½" to 4" sizes for line pressures from 1000 to 5000 psi. Valve is placed close to the work and operated from a central control point with an easy to handle air valve avoiding operator fatigue.

SOLENOID OPERATED AIR VALVES

Widely used for controlling single and double acting air cylinders, clutch and brake controls, etc. Solenoid is directly connected to valve operating mechanisms. ⅜" to 1½" sizes. 2-way, 3-way and 4-way actions.

For Fully Descriptive Data Sheets Write

C. B. HUNT & SON, Inc.

Hand, Foot, Lever, Cam, Pilot Diaphragm and Solenoid Control Valves

1993 EAST PERSHING STREET • SALEM, OHIO

Circle 62 on Reader Service Card

USEFUL LITERATURE

Continued

sections on end products, sizes, dash numbers and variable tolerances, dimensional data for installation of standard sizes, and cross-sectional drawings of installations.

Circle 222 on Reader Service Card

RELAYS . . . which are standard and carried in stock and suggested modifications which can be made to accomodate special requirements, are described in a new 44 page, 2 color, loose-leaf catalog. Listed in the catalog are the following types: midgets, circuit controls, special purpose, radio and high frequency, aircraft relays and contactors. Catalog can be obtained from Leach Relay Co., Div. of Leach Corp.

Circle 223 on Reader Service Card

SPECIAL HYDRAULIC DESIGNS . . . Exactor, Ltd. is organized to handle complete projects in the field of hydraulic engineering from small precision components to medium and heavy assemblies. After consultation with the company engineers, schematic drawings and detailed working drawings for production are prepared. Many

MORE POWER TO YOU
. . . from CENTURY!

CUSTOM HYDRAULIC POWER UNITS
Designed RIGHT!
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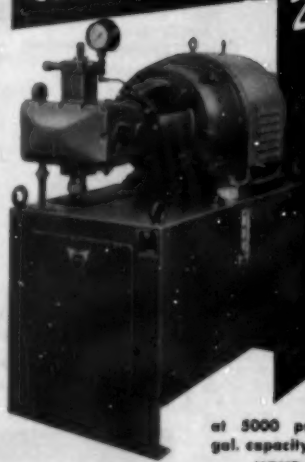


For example—
This Century designed and built Power Unit. 50 H. P. motor drives variable delivery pump with maximum output of 20 gpm at 5000 psi. Century reservoir is 125 gal. capacity.

YOUR INQUIRIES ARE INVITED

CENTURY HYDRAULICS, INC.
8866 GREENFIELD — DETROIT 28 MICHIGAN

Circle 27 on Reader Service Card

illustrations and examples of the type of projects handled are included in a bulletin on "Industrial Hydraulics". Several types of hydraulic controls are also included such as remote controls and crane brake controls.

Circle 224 on Reader Service Card

BELLOWS . . . A new 16 page, 2 color catalog No. 140 which is written to be used as a design guide has been released by Flexonics Corporation. The catalog covers manufacture, design, applications and specifications for bellows. A few of the subjects discussed include, production, design, specifications, specification guide sheet, a vapor pressure vs temperature chart and suggested applications. Also the various materials are given from which the bellows are made.

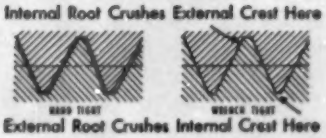
Circle 225 on Reader Service Card

VARIABLE SPEED PULLEYS . . . is one of the products outlined in literature released by Lovejoy Flexible Coupling Co. The various types are illustrated with a cross-section view and many of the features are presented. Ratings and dimensions and representative applications are shown for all the variable speed pulleys listed. The "V" belt line is designed to provide greater speed variation and flexibility and to withstand the intense squeezing action of the pulley sheave

UNBRAKO

dryseal-thread
PRESSURE PLUGS

HOW THEY WORK



In tightening of UNBRAKO Pressure Plugs, the roots of the flattened threads actually crush the sharper crests of the mating parts. Major and minor diameters are positively sealed, pressure tight without compound. Stocked and sold by leading industrial distributors everywhere. Write for literature. STANDARD PRESSED STEEL Co., Jenkintown 2, Pa.

UNBRAKO SOCKET SCREW DIVISION

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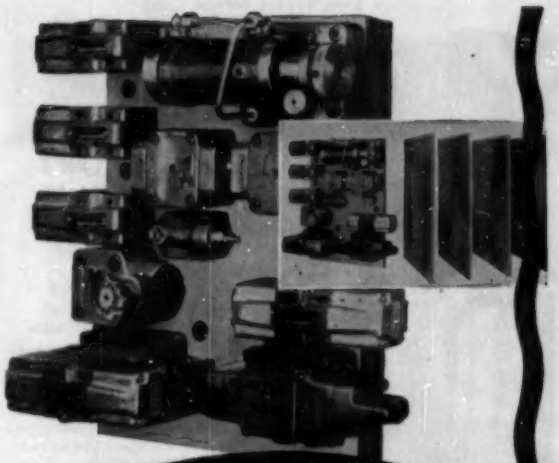


ALMO
HYDRAULIC
CONTROL MANIFOLDS

CONTROL SYSTEMS READY FOR OPERATION—NO CIRCUITS TO PONDER OVER AT INSTALLATION

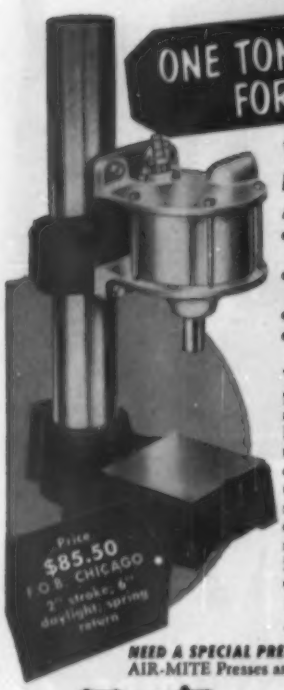
Leading machine manufacturers use these manifolds to cut costs and obtain permanent trouble-free operation. Send your hydraulic circuit print and sketch showing desired take-off connections. We'll prepare a manifold proposal—No obligation.

ALMO TOOL COMPANY
11470 Kaltz—Centerline, Mich.

"Design Wise"

Colonial Broach Co. uses an Almo manifold in this 15 ton capacity, 66" stroke dual-ram broaching machine.

Circle 5 on Reader Service Card



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Air-Mite Air Arbor Press Features:

- Solid Steel Column—greater strength, rigidity
- Brass Cylinder, Aluminum End Castings, Neoprene Piston Cups
- Accurately ground 5" x 5" table
- Quick set-up and stroke adjustment for maximum flexibility

You get more for your money when you choose AIR-MITE—more press, more utility and more production. Built by air press specialists to meet the demand for a low cost unit that could stand the gaff of high production work, AIR-MITE presses will show you quality, efficiency and economy you never thought possible at their price. Made in ¼, ½, ¾ and 1 ton capacities with spring or air return.

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AIR-HYDRO-PUMP

produces and holds

27,200 PSI

Hydraulic Pressure

(air required—100 lbs. psi)

- Air-Hydro-Pump is the world's finest pressure unit for rapid testing of Valves, Boilers, Piping, Pressure Vessels.
- Sustains constant pressure on Rolls, Rams, Presses.
- Portable for site testing.
- Water, Oil, Diluted Alkalis and Acids can be used.
- Made of non-ferrous metals.
- Fully automatic, holds any pressure indefinitely.
- Complete range of 34 models single or double acting.

High Pressure Control Valves to 30,000 p s i Also Available

WRITE FOR DETAILS

DAVIES BROS. 120 WALL STREET NEW YORK 5, N. Y.

PUMPS FOR EVERY ENGINEERING NEED

USEFUL LITERATURE

Continued

walls while transmitting full power capacity. Many other products are described including motor bases of various designs, select-o-speed transmissions. Ask for Form No. 118.

Circle 226 on Reader Service Card

AIR AND HYDRAULIC CYLINDERS . . . The 32 page booklet is divided into two sections, (1) air and low pressure hydraulic cylinders and (2) high pressure hydraulic cylinders. Each type of cylinder is illustrated with a line drawing. Every required dimension needed for installation is keyed on the drawing to a dimensional chart. The various mountings which are available are also illustrated. Engineering data and design information is also included. A cut-a-way view of a cylinder shows the construction. Many features of the design are pointed out. The booklet has been prepared by The Petch Co.

Circle 227 on Reader Service Card

LIQUID LEVEL MEASUREMENT . . . in closed tanks, either under pressure or vacuum is described in bulletin 2291, released by Minneapolis-Honeywell Regulator Co. The instrument, known as a "differential converter", converts differential pressure into proportionate air pressure which in turn is transmitted to indicators, recorders and controlling equipment. The operation of the device is completely described. Able to withstand temperatures up to 350 F and is rated for pressures of 750 or 1500 psi.

Circle 228 on Reader Service Card

METALLIC "O" RINGS . . . are described in a 20 page pocket size booklet prepared by United Aircraft Products, Inc. Identified as bulletin No. 54391, vented and standard "O" rings and the various industrial applications for static sealing of high and low pressures and temperatures are presented. The applications as shown will give an introduction to the new type "O" rings. Rings for specific requirements, can be manufactured by the company.

Circle 229 on Reader Service Card

ROTAMETER HANDBOOK . . . covering all phases of rotameter applications in laboratory, research and industrial pilot plant and allied processing fields, has been released by Brooks Rotameter Co. This is a complete manual, covering applications, size, selection, design and materials data, flow correction, operating and maintenance instructions. Factors furnished for temperature, pressure and specific gravity correction. Complete charts and tables cover full range of

Circle 128 on Reader Service Card

float materials, tube sizes and design limitations with regard to pressure and temperature. Bulletin No. 100 contains description of the contents of the 225 page bound book.

Circle 230 on Reader Service Card

HYDRAULIC VALVES . . . directional and functional, for 3000 psi flange connections are described in catalog No. 821 prepared by Hydraulic Power Division, The Hydraulic Press Mfg. Co. Many 4-way and 2-way valves are presented with complete information. Other valves covered in the literature are rotary pilot, relief, sequence, pressure reducing, counterbalance, flow controls, check valves and cylinder pressure release valve. All information is handled very thoroughly. The catalog is profusely illustrated.

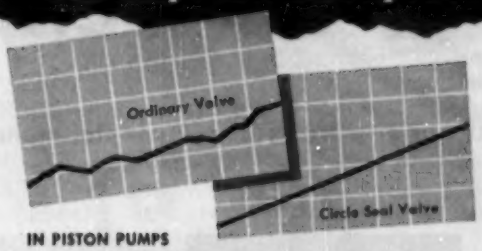
Circle 231 on Reader Service Card

FLOW REGULATOR . . . which is self operated, is described and illustrated in a new 4 page catalog 10-F-70 available from Fischer & Porter Company. The instrument maintains a constant rate of flow by means of energy derived from the fluid stream itself. The operation of the regulator is told in detail together with features and suggested applications. Specifications and dimensions together with outline drawings complete a very adequate description of the unit.

Circle 232 on Reader Service Card

Circle 66 on Reader Service Card

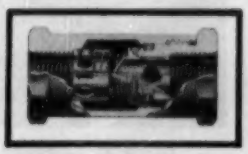
Check Valve *Leakage* Destroys Efficiency...



IN PISTON PUMPS
IN PLUNGER PUMPS

In hydraulic pumps, in chemical proportioning pumps—where constant volume must be maintained and leakage cannot be tolerated, Circle Seal Check Valves with floating "O" Ring construction provide the perfect answer because...

Circle Seal Check Valves *NEVER* Leak!



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CIRCLE SEAL *precision valves*

JAMES•POND•CLARK

2181 E. Foothill Blvd., Pasadena 8, Calif.

"Double Hook Dogs"

are Powered by NOPAK Cylinders on Monarch Four-Block Saw Mill Carriages

Close-up view of "Double Hook Dog" assembly shows how 3 NOPAK Model "E" Cylinders of different diameters and stroke lengths are employed to operate this mechanism. There are 4 of these "Double Hook Dogs" on each carriage.

•

Refer to Sweet's File for Product Designers or write for Bulletin SW-2.

Representatives in Principal Cities

The value of standard NOPAK Air Cylinders in heavy-duty service has been amply demonstrated by their performance on the huge Four-Block Saw Mill Carriages built by the Monarch Forge and Machine Co., Portland, Ore. Fourteen NOPAK Cylinders are used on each of these carriages which are extremely rugged in construction, and designed especially for the large western mills which utilize old growth fir and redwood logs. Monarch continues to specify NOPAK Cylinders because they really stand up under the rugged operating conditions to which they are subjected day after day, throughout the year.

GALLAND-HENNING NOPAK DIVISION

2743 S. 31st Street • Milwaukee 46, Wisconsin

NOPAK

VALVES AND CYLINDERS

DESIGNED for AIR and HYDRAULIC SERVICE

A 7659-½-H

Post Scripts of Industry

News about people, manufacturers and sales organizations

Edwin R. Campbell
The Electro Dynamic Motor and Generator Div.
General Dynamics Corp.

The Electro Dynamic Motor and Generator Division of the General Dynamics Corp. has named **Edwin R. Campbell** southern manager, it was announced by Dean W. Paul, sales manager. Campbell's Atlanta office address will be Electro Dynamic Division, 357 Foundry Street, N.W. Atlanta, Ga. He has had approximately seven years of business experience in the power machinery, speed and electric motor fields, plus service in engineering consulting.

Ed Karns
Cessna Industrial Hydraulic Div.,
Cessna Aircraft Co.

Ed Karns, sales representative at **Cessna Industrial Hydraulic Division** located at Hutchinson, Kansas, has been appointed sales manager for that division, reports Neil Whitney, plant manager. In his new capacity, he will be responsible for the sales representatives as well as all sales for the industrial hydraulics division.

Arthur E. Slaasted
Young Radiator Co.

F. M. Young, president **Young Radiator Company,** Racine, Wis., has announced the appointment of **Arthur E. Slaasted** as advertising and sales promotion manager. Before joining the company, Slaasted was advertising coordinator of power and electronic equipment, Allis-Chalmers Mfg. Co.

William D. Addy has recently become associated with **Device Engineering Company** of Philadelphia, as regional field liaison engineer for Eastern Pennsylvania and southern New Jersey. Addy is a specialist in the field of fluid flow and hydraulics, having formerly been associated with the Bureau of Reclamation, Department of Interior in Denver and the valve division of Minneapolis-Honeywell Regulator Co.

The Rucker Company, west coast distributors and manufacturers of fluid and pneumatic power systems, has been named exclusive western distributors for **Donnell Hydraulic Co.** equipment. The distributorship will cover the six western states of California, Arizona, Nevada, Oregon, Washington and Idaho, as well as the territories of Hawaii and Alaska. Headquarters for the Rucker Co. in northern California are located in Oakland; for southern California, in South Gate; and in the Pacific northwest in Seattle, Washington.

The Philadelphia office of the **Brown & Sharpe Mfg. Co.** of Providence, R. I., has been moved just outside of the city limits to 7 Bala Ave., Bala-Cynwyd, Pa. The new office is located in a recently completed building and continues under the direction of John J. McAleese.

E. F. Klesssig director of engineering at **Airway Products Inc.,** announces the appointment of **McKellar Graham** to chief designer. Graham is formerly of Vickers Inc., where for the past 14 years he was employed as a project engineer. He worked on mobile hydraulics which included pumps and control valves of all types. He also worked on

the power steering pump which is now in use on automotive applications.

American Engineering Company of Philadelphia, Pa. has appointed the following hydraulic representatives; **Sintes Dales Engineers**, New Orleans, La., entire states of Louisiana and Mississippi and the Gulf counties of Texas; **James Stewart Company**, Anherst, Mass., all of the New England states with northern part of Connecticut and counties along the eastern part of New York.

Robert T. Jones
Chiksan Company

Bev P. Ragsdale
Chiksan Company

Robert T. Jones has been appointed western regional sales manager and **Bev P. Ragsdale** has been promoted to senior field engineer in **Chiksan Company**, it has been announced by G. R. Winder, vice president and general sales manager.

Michael J. Curry has been elevated to the post of director of the application laboratory of the Chemical Division of **Celanese Corp. of America**. He will be in charge of application research and technical service programs assigned to the laboratory, which is located at Summit, New Jersey.

Hydraulic Power Division of **The Hydraulic Press Mfg. Company** of Mount Gilead, Ohio, has announced the appointment of **Kenneth V. Keidel** of Cleveland as a sales engineer. He has been attached to the company's central district sales office in Mount Gilead to service the Cleveland area. Prior to joining the company he was associated with the Worthington Corp. for four years. Also announced is the appointment of **Joseph H. Ondras** of Chicago, Ill., as a sales engineer. He has been attached to the company sales office at Chicago. Prior to joining the company, he was associated with Air Conversion Research. The appointment of **J. Jay Smith** of

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Post Scripts of Industry

Glen Ellyn, Ill., is announced. In his work as sales engineer, he will be attached to the district sales office at Chicago. Prior to joining the company he was associated with Magna Engineering Corp, in Menlo Park, Cal. **Raymond W. Arnesen** becomes sales engineer working out of the eastern district office at Teaneck, New Jersey. He was previously with the sales department of Writing Instrument Division of Eversharp, Inc. Also appointed is **William J. McManus** of Demarest, New Jersey, as a sales engineer. He also will work out of the eastern district sales office at Teaneck, New Jersey.

Otto M. Abram
The Weatherhead Co.

C. Allen Dolby
The Weatherhead Co.

The appointment of **C. Allen Dolby** to the position of sales manager of **The Weatherhead Company's** industrial distributor division was announced by Gene P. Robers, sales manager, distributor division. Dolby has a background of fifteen years in

sales work, most recently with The Osborn Manufacturing Co., where he was manager of distributor sales for four years. **Otto M. Abram** has been named western zone manager of the aviation division and industrial division of the company.

Rolf Kroekel
Sealol Corp.

The appointment of **Rolf Kroekel** as director of research and development has been announced by C. W. Williamson, Jr., president of **Sealol Corp.**

Additional facilities for design and manufacture, together with increased space and equipment for research and development of valves in the high pressure field have been occupied by **The Annin Company,** 6570 Telegraph Road, Los Angeles 22, Cal. Douglas Annin, president, states that the new plant will provide more than 30,000 sq ft of modern development and engineering facilities. **Henry C. Earle, Jr.,** sales manager directs activities of company representatives in key territories throughout the United States.

S. Riley Williams, **Worthington Corp.,** vice president in charge of foreign business, has announced the appointment of **B. R. McBath** as general European manager. McBath will headquarter at the French-Worthington Co., Paris, France.

Appointment of **Leon Marmon** as sales engineer for **The Parker Appliance Company** in the Cleve-

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Post Scripts of Industry

Leon Marmon
The Parker Appliance Co.

land area has been announced jointly by D. W. Holmes, vice president and D. A. Cameron, sales manager. Marmon, who will work out of the Cleveland district office, succeeds H. C. Jacob who has resigned after many years with the company. Marmon will be available for service and technical consultation to Parker distributors, including B. W. Rogers Company, Williams and Company and Cleveland Ball Bearing Company.

Stillman Rubber Co., of Los Angeles, has opened a Cleveland Division to assure speedy delivery of custom molded parts and to provide on-the-spot engineering service to the company's mid-western and eastern customers. **Charles Histed** will serve as district manager with offices at 23525 Lorain Rd.

David D. Hecht has been promoted to the post of manager of the product development department of the Chemical Division of **Celanese Corp. of America.** In his new assignment he will be responsible for all market and customer relationship aspects of the development of new chemical products.

D. A. Cameron, sales manager of **The Parker Appliance Company** in Cleveland, has named

Charles Histed
Stillman Rubber Co.

the following distributors: **Williams and Company** of 1109 South Preston, Louisville, Ky.; **Korody Marine Corp.**, 12822 Simms Ave., Hawthorne, Cal.—this new distributor will sell Parker products outside the continental limits of the United States and Canada; **Ritter Engineering Company** of 1515 West Liberty Ave., Pittsburgh 26, Pa.;

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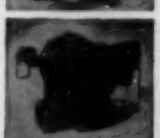

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Hope Rubber Company of Fitchburg, Mass.; and **B. W. Rogers Company** of Akron and Cleveland; and **Power Transmission Products** of 1107 N.W. 14th Ave., Portland 9, Oregon.

The promotion of **William Y. Gard** from design engineer to midwest sales representative of the **Warner Division, Detroit Harvester Company,** has been announced.

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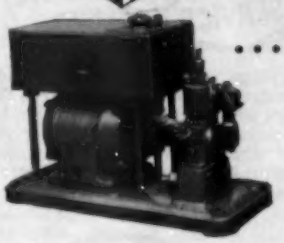

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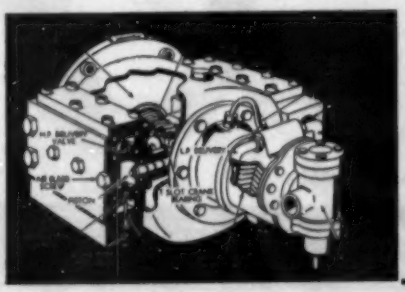

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Maurice E. Grant
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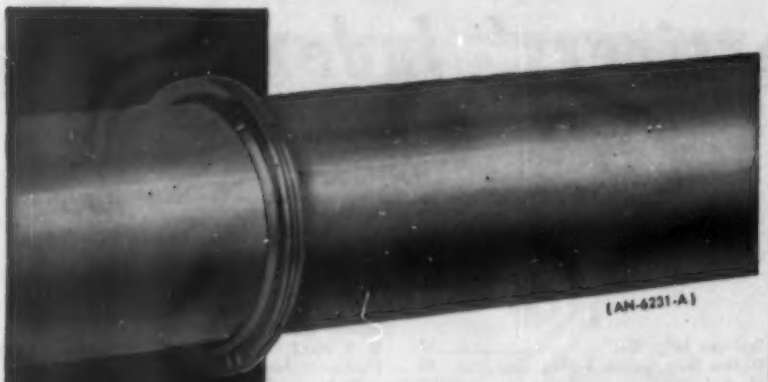

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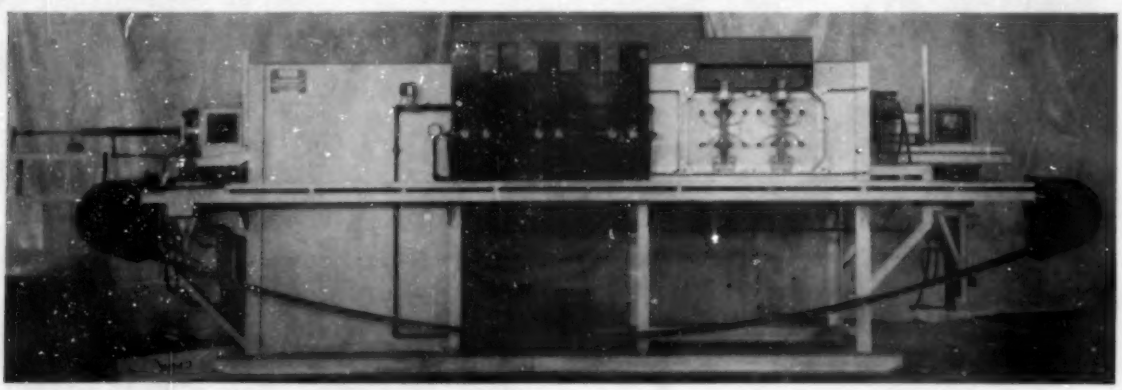
The magazine of Fluid Power—presents one of a series of applications showing the leading role of hydraulic and pneumatic circuits in the design of power systems and automatic control for America's production tools.

Fluid Power Circuit Solves Critical Control Problem for Germanium Reduction Furnace

A low pressure hydraulic system was chosen to power all actuating elements of a three zone germanium reduction furnace by American Electric Furnace, Inc. of Boston, Mass., because it was the best answer to the critical problem of moving the germanium material with extreme smoothness. Any shock or vibration of the powdered or molten germanium would result in spillage of the high cost material or damage of the thin walled graphite boats in which the germanium is carried through the furnace.

In addition, the hydraulic circuit was a relatively simple means of operating the relatively long heating cycle automatically—an essential factor to insure absolutely consistent results.

A hydraulic power package delivers 500 psi pressure to operate six cylinders, five of which are stock units. The only special cylinder, the index cylinder, moves the conveyor belt to position another boat for loading. The main pusher cylinder pushes the line of boats, one boat deeper in the furnace each cycle. A pair of elevator cylinders, one at each end of the retort, raises a loaded boat into line for entry and lowers the existing boat back to the conveyor level, respectively. The load and unload cylinders push loads from the conveyor to the elevator and elevator to conveyor respectively.



The control circuit is operated by two standard electric timers; an adjustable, repeating cycle timer and an automatic reset timer. The cycle timer initiates each cycle; the rest of each cycle is controlled automatically by action of limit switches and relays.

Fluid Power specialists are leading industry to better automatic equipment.
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